Government of Karnataka
Department of Health & Family Welfare
Karnataka Health Systems Development Project

Teaching modules on epidemic prone Diseases for Medical Officers in Karnataka

SUBJECTS

- Surveillance of epidemic prone diseases
- Out break investigation and control
- Investigation & control of our break -> Cholera
- Investigation & control of out break -> Viral Hepatitis
- Investigation & control of our break -> J.E.
- Investigation & control of out break -> Dengue fever

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Teaching module No. 1

SURVEILLANCE OF EPIDEMIC PRONE DISEASE

National Disease Surveillance Programme

Directorate of Health & F. W. Services
Bangalore-560 009, Govt. of Karnataka

SURVEILLANCE

OF

EPIDEMIC PRONE DISEASES

NATIONAL INSTITUTE OF COMMUNICABLE DISEASES
(DIRECTORATE GENERAL OF HEALTH SERVICES)
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1. Introduction

Surveillance of diseases is the continuing scrutiny of all aspects of the occurrence and spread of a disease that are pertinent to effective control. Communicable diseases constitute a significant disease burden and are major causes of morbidity, mortality and long-term severe mental and physical disabilities. Many of these diseases are epidemic prone.

The vulnerability of an area to an outbreak increases with increase in population density and high migratory habits of the population. The receptivity of an area to outbreaks is related to inadequate drinking water facilities, poor sanitary and adverse environmental conditions. Developmental activities such as large constructions, irrigation and industries can also increase the risks of epidemics unless adequate preventive and precautionary measures are inbuilt in the planning and implementation stages.

Epidemics are public health emergencies. Epidemics disrupt routine health services and are a major drain on resources. Besides direct costs in outbreak control measures and treatment of patients, the indirect costs due to negative impact on domestic and international tourism and trade can be significant. The avoidable human misery resulting from illness and death cannot be quantified in economic terms.

Not all outbreaks can be predicted or prevented. However, precautionary measures can be taken within the existing health infrastructure to reduce risks of outbreaks and to minimize the scale of the outbreak if it occurs. The effectiveness with which national programmes are implemented and monitored, the alertness for identification of early warning signals and the capacity for initiating recommended specific interventions in a timely manner are important to achieve the above objectives.

The course of an epidemic is dependent on how early the outbreak is identified and how effectively specific control measures are applied. The epidemiological impact of the outbreak control measures can be expected to be significant only if these measures are applied in time. Scarce resources are often wasted in undertaking such measures after the outbreak has already peaked and the outcome of such measures in limiting the spread of the outbreak, and in reducing the number of cases and deaths, is negligible.

When outbreaks occur or when the risk of such outbreaks is high, the co-operation of other government departments, non-governmental agencies and the community often becomes necessary. Such help will be more forthcoming if mechanisms for interaction have been developed before the onset of an outbreak.

The frequency of the occurrence of the epidemics is an indication of the inadequacy of the surveillance system and preparedness to identify and control outbreaks in a timely manner.

The purpose of the training programme is to develop skills to detect the outbreak in its early rising phase and to respond effectively to control its further spread.

2. Surveillance

Surveillance is **data collection for action.** Surveillance data are required for planning disease control activities and for evaluating impact. Disease surveillance data are also required to identify high risk areas or high risk age specific and other groups who require special attention. Early warning signals will be missed in the absence of an effective surveillance system.

To plan any disease control programme and to identify and control outbreaks, it is important to know the following:

- **who** get the diseases
- **how many** get them
- **where** they get them
- **when** they get them
- **why** they get them

There are five steps in the surveillance procedure which must be carried out at each level, starting from the PHC. Each level must have the capacity for analysing and using surveillance data for early detection, prevention and control of outbreaks. The five recommended steps are:

- collection of data
- compilation of data
- analysis and interpretation
- follow up action
- feedback

3. Prioritisation of diseases for surveillance

There are many communicable diseases which are widespread and are major causes of morbidity and mortality. Many of these diseases also have the potential of causing large outbreaks. Most of the diseases with an epidemic potential are either water borne, vector borne or are transmitted through person to person.

Besides the epidemic prone diseases, the surveillance system must also include diseases which are covered under the national programmes. These diseases account for a significant disease burden, lead to lifelong severe mental and physical disabilities and are usually amenable to control through cost effective means.

The existing health infrastructure can be effectively used to introduce a system of early warning signals or 'trigger events', to detect an outbreak in the early rising phase and to control it effectively. Orientation of the medical officers and the paramedical personnel will be needed to make the programme a success.

4. Prerequisites for effective surveillance

Prerequisite for effective surveillance are:

- use of standard case definitions
- ensuring regularity of the reports
- action on the reports

For developing an effective disease surveillance system, the district health officer/PHC medical officer must also be clear about:

- what information to gather
- how often to compile and analyse the data
- how often and to whom to report
- what proforma or formats to use
- what action to take

The data collected should be uniform, regular and timely. Standard case definitions are important to ensure uniformity in reporting so that all reporting units use the same criteria for reporting cases. It is also important to have a list of all reporting units so that the regularity and timeliness of the reports is

checked. If no cases are seen, a nil report should be submitted. All levels in the system must:

- have the standard case definitions
- have a list of all reporting units
- monitor receipt of reports in time
- monitor completeness of reports

The standard case definition of diseases is given in a separate manual. The cases have been classified as:

- suspect - diagnosis made on the basis of history by paramedical personnel and members of the community

- presumptive - diagnosis made on typical history and clinical examination by a medical officer

- confirmed - clinical diagnosis by a medical officer and/or positive laboratory identification

4.1 Regularity of reports

Monitoring the regularity of surveillance reports is an important function of the surveillance system. A list of all reporting units in the area must be kept. The Chief Medical Officer of Health of the district must identify the reporting units. Besides the PHCs and CHCs, hospitals, large dispensaries and clinics should be included as reporting units.

4.2 Frequency of reporting

A system of monthly reporting of disease and programme specific data already exists in the districts. The routine reporting of cases and deaths should continue.

Many epidemic prone communicable diseases have short incubation period. If a review of the data is made only on a monthly basis, it might delay the timely identification of an outbreak in the early rising phase. Reporting units may consider the weekly analysis of cases of epidemic diseases seen in their institutions. If the number of cases is doubled for two consecutive weeks, it should serve as a warning signal for investigations. The area of residence of the patients should be checked and if these cases are clustered with respect to time and place, an immediate field visit is indicated. An epidemic can be averted by taking appropriate control measures in time.

If an outbreak is suspected or identified, the next level should be notified immediately.

Some outbreaks may be explosive and become apparent in a short time. This should be investigated immediately. Cases of acute haemorrhagic fever or encephalopathy should be investigated and reported immediately.

Daily reports are necessary once an outbreak has been identified so that the situation can be monitored. Neighbouring areas would need to step up surveillance activities also to rule out the spread of the outbreak. After the outbreak has subsided, weekly reports should be continued for at least double the maximum incubation period of the disease.

Only data that is used should be collected otherwise it will clutter and overburden the system. All the data collected at PHC or district is not required to be transmitted to the state or central levels unless a special request is received.

5. Methods of data collection

Several methods can be used for collecting data. While routine reporting (passive surveillance) is universalised, other methods are need and area specific. These include:

- sentinel surveillance
- active surveillance (active search for cases)
- vector surveillance
- laboratory surveillance
- sample surveys
- outbreak investigations
- special studies

5.1 Routine reporting (institutional based or passive reporting)

All the national health programmes require that the cases and deaths recorded in the out-patient or in-patient departments of hospitals, dispensaries, community health centres, primary health centres and other health facilities manned by a medical officer are reported to the local health authority on a monthly basis. The consolidated report of the district is forwarded to the state health officer. For some national programmes, a copy of the district report is also forwarded to the concerned officer at the central level.

At each level in the system, the report is required to be analysed and appropriate action taken as indicated. The reports should be checked for completeness and regularity as these factors can influence the analysis of the reports.

Each reporting unit must have the following details available in their records for each case. The details of the cases are essential for outbreak investigations. Each reporting unit is advised to 'spot-map' the cases at least for a few selected diseases so that high-risk pockets could be identified. The line listing is, however, required to be submitted on a regular basis only for those diseases for which goals for eradication/ elimination have been set.

- name of the patient
- name of the mother or father
- full postal address of the residence (the address must be complete to facilitate home visit, if required. It might be helpful to record the name of the nearest sub-centre and PHC, for example, if the patient can provide this information)
- age
- sex
- date of onset
- immunization status (if child under five years of age and vaccine is available for public health use)
- outcome
- date of collection of clinical samples (if any) and laboratory results

5.2 *Sentinel surveillance*

A sentinel surveillance system is developed to obtain more reliable and extensive disease information than is available through the routine reporting. A hospital, health centre, laboratory or a rehabilitation centre which caters to a relatively large number of cases of the disease can be considered as a sentinel centre. A sentinel centre can provide information on one or more diseases.

Since the sentinel centres are carefully selected and because the number of the reporting units is much smaller, it is easier to maintain the quality and regularity of the reports.

There should be a close liaison between the sentinel centre and the local health office. The sentinel centre can help in providing:

- line lists of cases of selected diseases which is essential for epidemiological analysis
- early warning signals which should trigger action for outbreak investigations

The sentinel centre data will not include all cases in the area. However, if one or more sentinel centres have been carefully selected, it will include sufficiently large number of cases for epidemiological analysis. Data from sentinel centres are useful to determine trends in the incidence of the reported disease.

The district hospital, infectious diseases hospital, medical college hospital (if located in the district) and other large hospitals or laboratories should be included as sentinel centres and reports from these centres should be analysed separately. These centres would also be submitting the routine monthly report under the passive surveillance system.

5.3 *Active surveillance*

However good the routine reporting system, there will still be cases that will not be recorded under this system. Patients with mild or moderate severity may not seek treatment and some may go to private practitioners. It is also possible that patients in severe condition are taken directly to a large hospital in another district for specialized care. Some cases may die within a short period of onset of symptoms without receiving care at a health facility such as cases of neonatal tetanus.

Active surveillance or active search for cases is resource intensive. The decision to start active surveillance depends on many factors and ground situations. Active search may be called for under the following circumstances:

- during outbreaks to determine the extent of the outbreak and keep mortality rates low by initiating early treatment. Active surveillance is carried out to know the magnitude of the problem which will help in planning logistics for control. In addition, it will give baseline data to evaluate control strategy. It also helps in understanding the genesis of the outbreak.

- as the number of cases of a disease decline to negligible levels and it becomes important to receive information on every single case as quickly as possible so that further

transmission is interrupted by initiating outbreak control measures. For example, active surveillance is recommended for acute flaccid paralysis (AFP).

- to trace cases and contacts over a limited period of time for selective interventions to interrupt transmission. This strategy is recommended in the yaws affected districts.

- to confirm the absence of even a single case. This is done during the pre-certification phase for disease eradication as 'zero' incidence has to be maintained for a period of three years. The last case of guinea worm disease was reported in July 1996. If the zero status is maintained, eradication of guinea worm disease will be certified in India in 1999.

During field visits by the supervisors, absence of disease can be confirmed by contacting few key persons such as a school teacher, gram pradhan, anganwadi worker and others.

The health personnel, outreach personnel of other government departments, non-governmental organizations and the members of the community must be encouraged to report cases. The lay case definition of the disease should be widely circulated for this purpose. **The health personnel should not be punished or discouraged in any way from reporting cases as this will lead to suppression of vital information.**

5.4 Vector surveillance

Vector surveillance is important to monitor the existing vectors in the area. Increase in the density of the vectors or their breeding sites should be taken as early warning signals for vector borne outbreaks. Aedes mosquito, the vector for dengue fever, prefers artificial collection of water for breeding (for eg. desert coolers, cement tanks, broken unused pots, tyres etc.). A house index of 10% or more indicates potential for outbreak of dengue/DHF. The culex mosquitoes breed in dirty and polluted water, whereas anopheles prefers clean water for breeding.

Vector surveillance is especially important in selected epidemic prone pockets such as areas with seepage from irrigation canals, dam projects and flood prone areas so that anti-vector measures can be initiated as a precautionary measure to prevent an outbreak.

Vector surveillance will also document the impact of the routine measures for vector control under the National Malaria Eradication Programme (NMEP).

District health officer should have linkage with the Zonal Entomologists. Data on entomological survey carried out in the past should be fully utilised for planning of anti-vector measures. If no entomological studies have been carried out, these can be planned in consultation with the zonal/ state entomologist.

5.5 *Laboratory surveillance*

Testing water samples for coliform organisms is a measure to determine the risk of water borne outbreaks. Water quality monitoring is recommended in vulnerable pockets and from sources supplying drinking water to a large population.

Checking the chlorination levels of the water is also important, especially during the monsoon and post-monsoon periods. These measures by the health department are precautionary measures in addition to the mandatory requirements of the concerned departments.

Laboratory surveillance must be stepped up in anticipation or in the event of an outbreak. Serological and other laboratory based surveys are sometimes conducted as research projects to collect baseline prevalence rates or to identify high risk factors, age-groups or population sub-groups.

The identification of new agents and changes in the behaviour of micro-organisms especially in relation to susceptibility to anti-microbial are also important components of laboratory surveillance.

Laboratory also plays a important role in surveillance of diseases like dengue fever (monitoring of fever cases for antibodies against dengue), cholera (isolation of *V.cholerae* from stool sample) and poliomyelitis (isolation of poliovirus from stool samples of AFP cases).

Clinical samples should be collected and transported properly to the identified laboratories for appropriate tests. The samples should be labelled properly and accompanied with requisite epidemiological information.

5.5 *Sample surveys*

Surveys give reliable epidemiological information. These are particularly useful to collect baseline data prior to the launch of a large control programme, especially if such data are lacking through other sources.

Surveys are, however, difficult to conduct and are relatively expensive. The sample size, sampling procedure, methodology, questionnaires and forms must be well designed to avoid bias and misinterpretation of data. Moreover, the results of the surveys are **area and time specific**. The results of the surveys are relevant only to the area in which these were conducted and the period when these were conducted.

Not all surveys are, however, difficult and standard guidelines are available. These surveys can be conducted after a period of 3 to 5 years or more to document impact. Such surveys include multi-indicator studies on ORT and ARI in children. Stool surveys of school children for assessing the prevalence of helminthic infestation can also be organized.

It is expected that if a survey is conducted in a district, it will be in collaboration with the state and central health authorities. Since this activity is not recommended as a routine, further information on the subject can be obtained from the concerned state officer directly.

5.7 *Outbreak investigations*

Outbreaks investigations provide a rich source of epidemiological information. The outbreaks should be investigated to ascertain its aetiology and understand why they occurred as well as to identify high risk areas and groups. Laboratory help should be utilised in establishing the diagnosis of early cases only. Once the cause of outbreak is confirmed, laboratory support should not be wasted for each and every case. The data collected as a result of outbreak investigations must be utilised for improving programme activities and the surveillance system as well as for filling gaps identified as a result of these investigations.

The results should be shared with other district officers and other states so that the experience gained could be effectively used for preventing such outbreaks in these areas.

5.8 *Special studies*

Special studies are sometimes required to study problems that are not addressed through the methods of data collection listed above. Some districts, for example, may have a high prevalence of cases linked to or suspected to be due to environmental pollution; other districts may have problems related to multi-drug resistant micro-organisms.

6. Data to collect

Usually only the number of cases and deaths are reported under the routine reporting system. If the number of cases of a disease is large, it is neither practical nor necessary to collect detailed information on each case. However, as mentioned earlier, each treatment centre must keep a record of all cases. Relevant information may be obtained for selected epidemic prone diseases from selected centres (sentinel hospitals) so that high risk areas and groups (for example related to age and immunization status) can be identified. Besides the name of the patient, name of father or mother should be recorded to trace the patient for further investigations if necessary. The following information is required for making policy decisions and to evaluate impact:

- age
- sex
- date of onset of symptoms
- outcome
- immunization status (for vaccine preventable diseases in children under five years of age)
- residential address
- date of collection of sample and lab. report (if any)

6.1 *Age*

Age is important to identify age-groups at the highest risk. This information is important in understanding disease dynamics and formulation of control strategies. Data on age of cases for vaccine preventable diseases helps to determine the immunization schedule and to have cut-off age limits during outbreaks which can be controlled by vaccination. Some diseases are more severe in the higher age-groups. Some diseases are seen more in one age-group than another and this might help in differential diagnosis. Age, for example, is one of the criteria in the differential diagnosis of acute flaccid paralysis in children.

6.2 *Sex*

Gender is recorded to determine the sex differential which is common in some diseases with either males or females being more prone depending on the risk factors. Hospital records may however also reflect the medical attention given to male members of the family as compared to the females. For example, while almost all cases of neonatal tetanus admitted in hospitals are males, this is due to the fact that the female child is not brought for treatment.

6.3 *Date of onset of symptoms*

The date of onset of symptoms is important for determining the course of the outbreak and to undertake epidemiological investigations. Information regarding the onset of symptoms is also necessary for interpretation of laboratory tests.

6.4 *Outcome*

One of major objectives of the national programmes and outbreak control measures is to minimize mortality and case fatality rates. Recording the outcome of the diseases in terms of whether the patient recovered fully or has long-term complications as a result of the disease or died will also indirectly give information on the quality of the management of cases if there are wide variations in the clinical outcome in different hospitals.

High case fatality rates may trigger further investigations and identify other underlying cause (s) in the area.

6.5 *Immunization status*

Immunization is one of the most cost effective public health programmes and no child should be denied its benefits. Contacts with the health care delivery system should be used to check the immunization status of all children under five years of age so that they could be immunized as appropriate for the age. Recording the immunization status is particularly important if the case is of a vaccine preventable disease.

Occasionally a child who is fully vaccinated at the appropriate age with potent vaccine may get the disease. This is because the vaccine efficacy is usually less than 100%. Even if a potent vaccine is used at the right age in the right dose, some children will not be fully protected. If a large proportion of cases occur in fully vaccinated children, it should be investigated.

While the immunization status of a child may not have a direct relevance for diseases other than the vaccine preventable, high immunization coverage would indicate a healthy public health system with a good outreach and IEC efforts. On the other hand, if a large number of children are non-immunized, it reflects poor contact with the health system or other problems of access to health care.

6.6 Residential address

Residential address of the patients helps in identifying high risk area. It is not only essential to apply control measures in the affected areas, but is also useful to understand the natural history of diseases. Some diseases are more prevalent in rural areas (for example, JE, neonatal tetanus) whereas the others affect mainly urban population (Dengue fever). Diseases like kala-azar are confined to certain geographical area (Bihar, some districts in West Bengal and U.P.).

7. Compilation of Data

Data should be compiled to describe the diseases in terms of time, place and person. There are two methods of compiling data.

- Tabulation
- Drawing (Graphs, Charts, Maps)

7.1 Tabulation

Usually the data collected is large in amount and therefore, should be classified and presented in the form of frequency distribution table. This is very important step before statistical analysis of data. It groups large number of observations and presents the data very concisely giving all information at a glance.

Example 1: Table 1 shows the geographic distribution of laboratory confirmed cholera cases in Delhi during 1988.

Table 1
Laboratory confirmed cholera cases in Delhi by Zone, 1988

Zone	Cases	Percent
City Zone	10	0.7
S.P.Zone	45	2.9
Karol Bagh	43	2.8
West Zone	50	3.3
Civil Lines	508	33.1
Narela	48	3.1
Najafgarh	79	5.1
South Zone	69	4.5
N.D.	26	1.7
Shahdara	583	38.0
NDMC	15	1.0
Cantonment	11	0.7
Zone Unknown	49	3.2
Total	1536	100.0

Note: 113 cases were from outside Delhi.
Records were not available for 59 cases.

It is evident from Table 1 that most of the cholera cases occurred in Shahdara (38%) and Civil Lines (33.1%) zones.

Example 2: Table 2 describes the vaccination status of measles cases which occurred in 7 districts of Uttar Pradesh during the epidemic of 1996.

Table 2
Immunization status of measles cases in Uttar Pradesh, 1996 *

District	No. of measles cases examined	No. immunized	% immunized
Bareilly	173	5	3.0
Baharaich	41	2	4.8
Hamirpur	108	6	5.6
Maharajganj	363	64	17.6
Kheri	315	66	20.9
Lucknow	102	24	23.5
Almora	31	9	29.0
All	1133	175	15.4

* More than 9 months of age.

It is clear from Table 2 that almost 85% of the cases had not been vaccinated against measles.

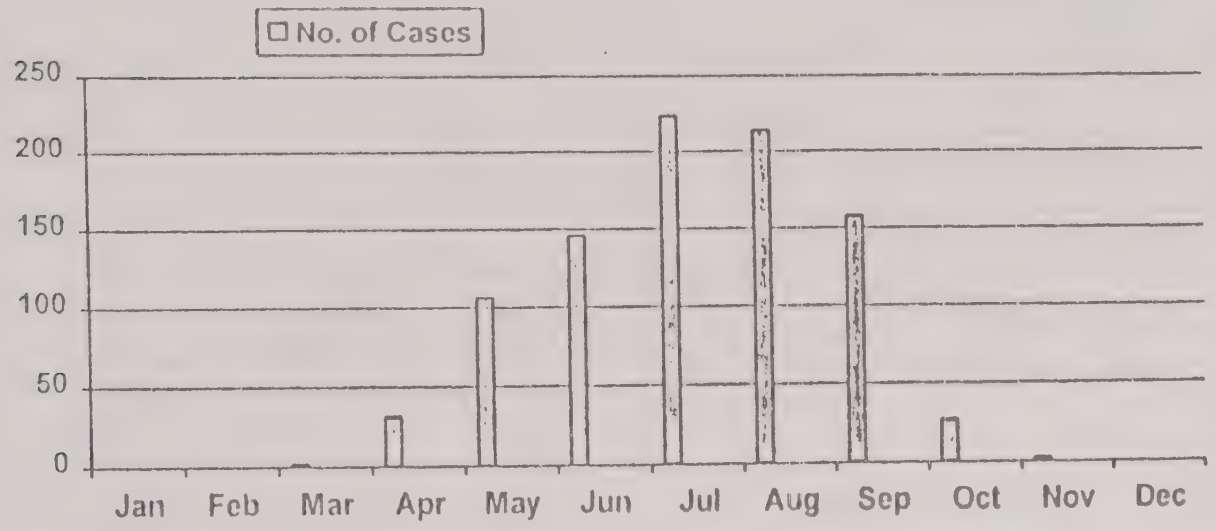
7.2 *Drawing*

After group-wise tabulation, the frequencies of characteristics can be presented by charts and graphs. They are useful for quick eye reading of data.

Line graph, bar diagram, pie diagram and maps are used frequently in disease surveillance. For example, in order to monitor the incidence i.e. number of new cases in a defined population during a specified period of time, it is necessary to maintain diagram (charts) or graphs. These charts and graphs show the number of cases of the diseases for each reporting period. With charts and graphs it is easy to visualise the number of cases which occurred in each reporting period.

7.2.1 Bar Diagrams

Figure 1
Seasonality of cholera in Delhi, 1996
(Bar Diagram)



Example 3 **Figure 1** is a sample bar diagram for the number of laboratory confirmed cases of cholera in Delhi in 1996.

By looking at the chart it is easy to determine how many bacteriologically proved cases of cholera occurred each month in Delhi. For example, most of the cases occurred from May to September, while Dec-Feb were completely free from the disease.

7.2.2 Line Graphs

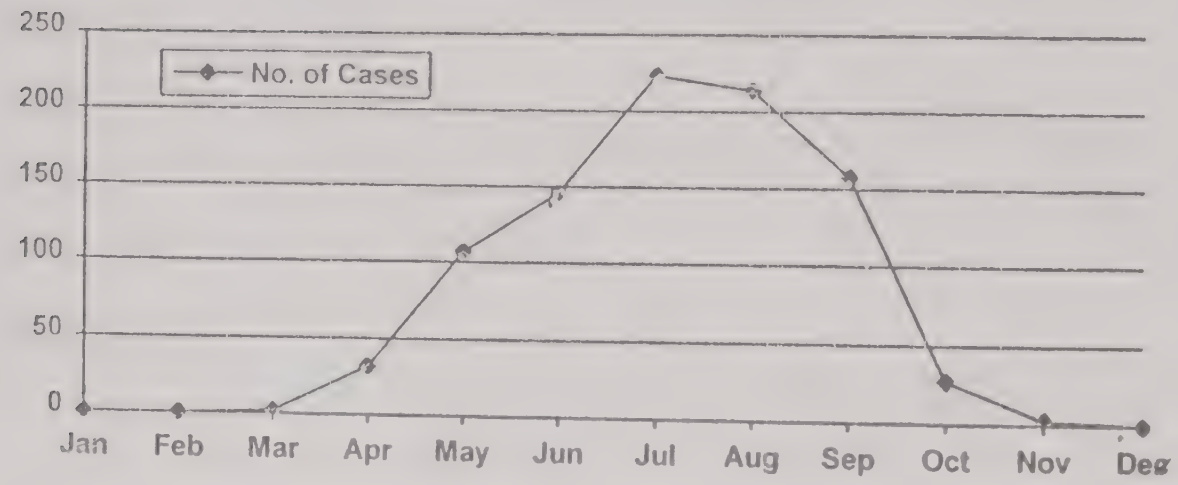
In order to maintain a disease graph, perform the following tasks:

On the first day of each reporting period, count the number of cases of disease diagnosed during the previous reporting period.

Place a dot on the graph directly above the mark for that reporting period.

Draw a line from the previous dot to the new one, so that you will have a clear picture of the trend in the incidence of disease. If the line goes down from left to right, the number of cases is decreasing. If the line goes up from left to right, the number of cases is increasing.

Figure 2
Seasonality of cholera in Delhi, 1996
(Line Graph)



Example 4: Fig 2 drawn from the same data as in Fig 1. You can see that cholera appeared in March, had peaks in July-August and almost disappeared in November-December.

During ongoing disease surveillance of epidemic prone diseases, compile the data weekly rather than monthly (Table 3).

Table 3
Weekly distribution of cases of epidemic-prone diseases attending a health institution

Diseases	Weeks 1	2	3	4	5	6	7	8	9	... 52
Diarrhoea										
Jaundice										
Malaria										
Measles										

Exercise 1

- Draw Bar diagram or line graph using data in Table No.4.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Week

Table 4
Week-wise reported cases of Measles in District Maharajganj, Uttar Pradesh, 1996

Period ending week	No. of cases	Period ending week	No. of cases
1	0	13	0
2	0	14	51
3	6	15	0
4	8	16	0
5	0	17	0
6	0	18	0
7	0	19	0
8	0	20	0
9	0	21	42
10	0	22	31
11	0	23	15
12	9	24	214

7.2.3 Maps

A map is commonly used to monitor the location of diseases during investigation. You can tell exactly where cases are occurring by just looking at the map. The map will also help you in determining how serious the disease situation is in different reporting units.

Place pins or draw dots on the map to indicate the areas where cases of target disease are recorded.

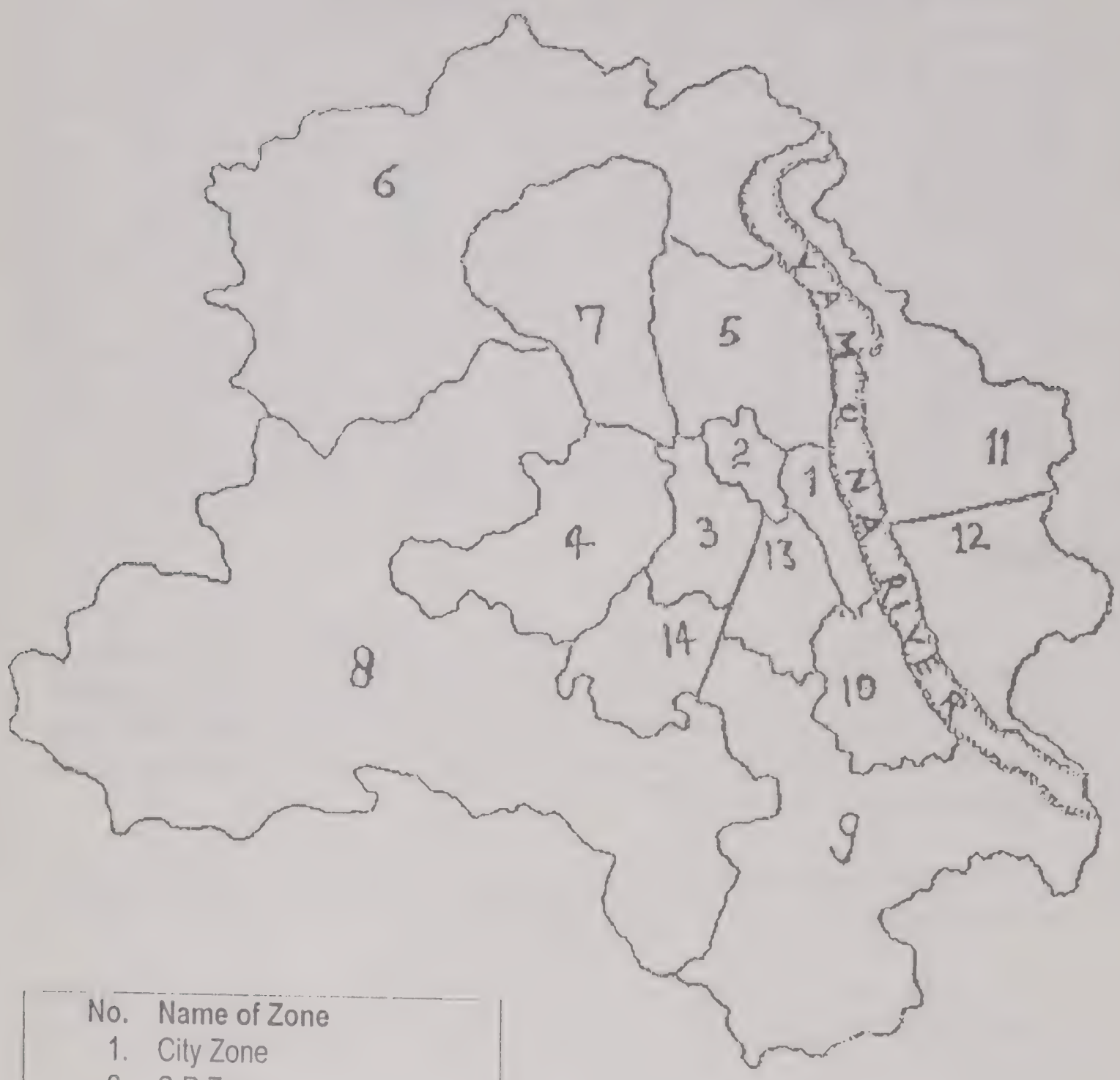
You can monitor locations of many diseases by using different coloured pins or dots. Each colour represents a different disease.

If the number of cases of a disease reported in an area is very large, you can use a pin or dot to represent more than one case. However, be sure to place the pins at the area where the cases occurred (and not where the cases were diagnosed).

If you have a computer, EPI.MAP can be used.

Exercise 2

- Draw the map diagram using data in Table 1. Map of Delhi is being provided.



No.	Name of Zone
1.	City Zone
2.	S P Zone
3.	Karol Bagh Zone
4.	West Zone
5.	Civil Lines Zone
6&7.	Narela Zone
8.	Najafgarh Zone
9.	South Zone
10.	New Delhi
11&12.	Shahdara
13.	NDMC
14.	Cantonment

8. ANALYSE DATA

After the data have been compiled, it needs to be analysed and interpreted to find out useful information. For proper analysis of data, compare the morbidity or mortality in two different areas or in the same area over a period of time. Data should be compared in different groups also which relate to the characteristics of the host viz age, sex, immunization status etc.

Rates rather than absolute numbers should be used to solve the problem of change in population. Cases should be analysed by age, sex and residence status. The problem of completeness of reports can be solved by utilization of sentinel sites.

For comparing the data in the same area over a period of time, the number of cases reported during the period under review should be compared with the data reported during the previous week/month and with corresponding period of previous years. Is the number higher, lower or nearly same? Whatever the answer the analysis is not complete until you have explained the most probable reason for it.

Exercise 3

Table 1 shows the cases of cholera in Delhi by zone in 1988.

- Name the zone that suffered most in 1988 epidemic of cholera.

Do you want more information ?

If yes

What information ?

_____
_____
_____
_____
_____
_____
_____

The best way to define the extent of problem in an area is by rate rather than absolute number of cases. Rates take the denominator (population) in account.

Table 5 gives the incidence of cholera per 100,000 population. Now it is clear that the rate was maximum in Civil line Zone rather than Shahdara Zone. Therefore, when you are comparing the morbidity or mortality in two different areas or in the same area over a period of time, the attack rate rather than absolute number should be taken into account.

Table 5
Zone-wise incidence of cholera in Delhi, 1988

Zone	Cases	Percentage	Incidence per 100,000 population
City Zone	10	0.7	1.9
S.P.Zone	45	2.9	8.7
Karol Bagh	43	2.8	5.6
West Zone	50	3.3	5.2
Civil Lines	508	33.1	85.6
Narela	48	3.1	16.9
Najafgarh	79	5.1	14.0
South Zone	69	4.5	10.8
N.D.	26	1.7	5.3
Shahdara	583	38.0	55.5
NDMC	15	1.0	1.5
Cantonment	11	0.7	9.1
Zone Unknown	49	3.2	

However, when the denominator is not likely to change much during a period under examination, even the absolute numbers can be compared. For example, examine the data shown in Table 4.

Exercise 4

- What inference you draw from Table 4.

- What more information, if available, can make the data more meaningful?

_____
_____
_____
_____
_____
_____

Exercise 5

- How the information available in Fig. 1 or 2 are useful to you as a programme manager?

_____
_____
_____
_____
_____
_____

Table 6
Reported cases of Gastro-enteritis in some districts of UP, 1982-89

District	1982	1983	1984	1985	1986	1987	1988	1989
Agra	192	202	395	139	119	58	23	5
Alligarh	-	-	-	-	-	-	69	1
Mathura	2	10	73	3	-	78	105	10
Jhansi	2	44	75	113	184	29	264	1
Etwah	-	-	121	24	-	15	11	7
Rai Bareilly	-	98	157	96	84	42	24	39
Sitapur	73	177	166	131	-	79	128	88
Saharanpur	-	-	13	-	5	-	274	-
Ballia	-	5	6	44	26	17	1084	216

Exercise 6

Examine table 6 carefully and answer the following questions.

- Do you think that the reported morbidity on GE is correct?

_____
_____
_____
_____
_____
_____

If yes: Substantiate your answer with arguments.

If no : Are the gastroenteritis cases under reported?

Exercise 7

- Enumerate the possible reasons of under reporting of acute diarrhoea, measles and malaria in a district?

Exercise 8

- How can you solve the problem of under-reporting of disease morbidity and mortality.

Exercise 9

Despite limitations of the data reported through routine surveillance system, useful information can be drawn if the data is compiled properly and interpreted cautiously.

While investigating an outbreak of Malaria in PHC Talgram of district Farrukhabad, UP in October 1991, an epidemiologist visited the adjoining PHC Jalalabad which was not reported to be affected during the current outbreak. Table 7 shows data on Malaria from PHC Jalalabad during 1 January 1987-October 1991.

Table 7
Malaria situation in PHC Jalalabad, Farrukhabad, 1987-1991

Year →	1987		1988		1989		1990		1991	
Months ↓	Slides collected	Slides Positive	Slides collected	Slides Positive	Slides collected	Slides Positive	Slides collected	Slides Positive	Slides collected	Slides Positive
Jan	109	1	414	0	276	1	273	0	267	0
Feb.	187	1	337	0	287	0	348	0	234	0
Mar.	203	1	278	0	263	0	341	0	259	0
Apr.	254	0	334	2	408	0	252	0	443	0
May.	200	2	293	0	283	4	229	0	347	0
Jun.	170	0	211	0	324	0	323	0	372	0
Jul.	267	3	326	0	345	1	550	0	483	0
Aug.	292	3	1009	20	1602	8	1440	5	1001	7
Sep.	418	11	830	22	1492	1	941	9	2036	19
Oct.	301	4	650	0	862	0	497	0	3187*	104
Nov.	287	0	438	0	333	0	289	0		
Dec.	230	0	353	1	279	0	295	0		
Total	2918	26	5473	45	6754	15	5778	14	8629*	130

*1227 slides were still to be examined.

- Do you agree with the local health officials that PHC Jalalabad was not affected during the current outbreak of Malaria?

If yes: Substantiate your answer with arguments.

If no : why the area was not considered to be affected by the outbreak?

- Calculate the SPR for each year. Do you still feel that PHC Jalalabad did not register unusual increase in cases during October 1991?

If no: Why were the local health authorities not aware of the increase in cases in October 1991?

The Medical Officer I/C of the PHC was not aware of the unusual increase in the Malaria cases because the data was not compiled properly. You could appreciate the increase in incidence because the data has been compiled properly for you. This example highlights the importance of compiling the data properly before analysis and interpretation.

Exercise 10

Table 8

Typhoid fever in PHC Galore, district Hamirpur, Himachal Pradesh, June 1991: Distribution of cases by sex and village

Village	Males	Females	Total
Lanjiana	22	31	53
Daswin	17	1	18
Pahal	1	2	3
Halti	2	3	5
Ghirmani	4	0	4
5 other villages	6	12	18
Total	52	49	101

Note: All the villages had almost equal population.

- Provide comments on the data shown in Table 8.

_____
_____
_____
_____
_____

- Were male and females affected differently? Substantiate your answer with arguments.

_____
_____
_____
_____
_____

- You must have appreciated that cases were more in two villages (Lanjiana and Daswin) than other villages. Can you provide some explanation for such geographic & sex distribution of typhoid fever in this PHC?

_____
_____
_____
_____
_____

A marriage function was held in village Lanjiana in May, 1991. The bridegroom belonged to village Daswin and only males accompanied the marriage party. The cases started coming two weeks after this function. In fact, the outbreak occurred due to consumption of contaminated water from a local water body.

Exercise 11

Screening method for estimating vaccine effectiveness is a simple, rapid and cheap surveillance tool. It requires data on proportion vaccinated among the cases and population, which may be available in many circumstances. For example, 26 of 136 (19.1%) cases of acute poliomyelitis in Delhi in 1991 (age group of 12-23 months) were found having received 3 doses of oral polio vaccine. Immunization coverage surveys in J.J. colonies and resettlement colonies of Delhi which contributed most of the poliomyelitis cases in Delhi revealed vaccine coverage of three doses of OPV as 64.5%. Using the curves shown in figure 3, the vaccine effectiveness was calculated as around 90%.

Percentage of Cases Vaccinated (PCV) per Percentage of Population Vaccinated (PPV), for 7 Values of Vaccine Efficacy (VE)

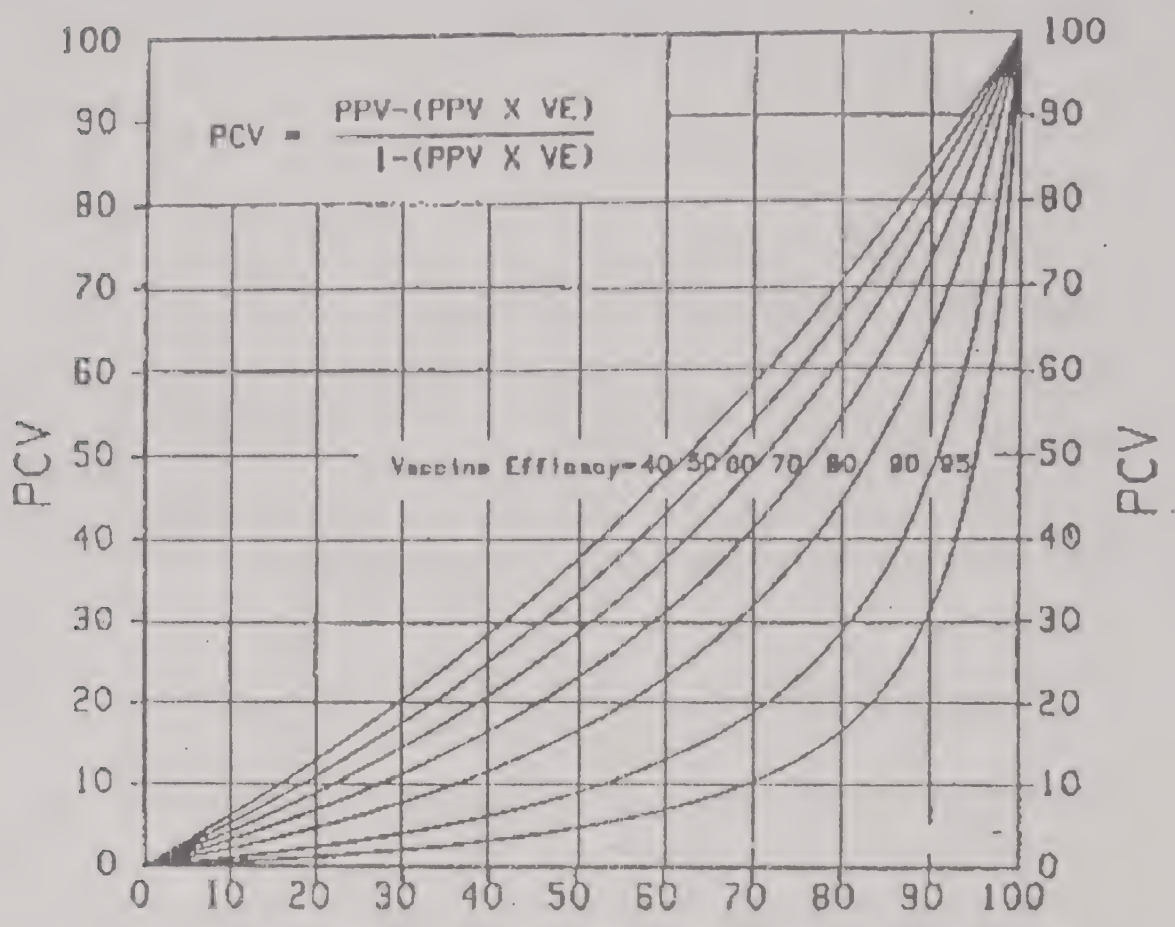


Figure - 3

- Assuming that measles vaccine is 90% effective when administered at 9 months of age, calculate the measles vaccine coverage in UP using the data from Table- 2.

3.1 Increasing Completeness of Reports

One method to overcome incompleteness of reporting from multiple sites is to chose what is known as a sentinel site - an institution that consistently and completely reports for all cases of the diseases under study. However, it is important to look beneath the surface of yearly compilation of reports from hospital. For example, it is possible that the hospital has not completely reported for each month of the year.

The number of hospital cases may also be artificially higher if improved standards of living and transportation make it possible for more persons residing from outside of the normal catchment area of the hospital to have access to the hospital.

It is also necessary to compensate for a changing population in the hospital's catchment area. It can be done by converting the absolute number of cases into rates. Rates take the changing population denominator into account and correct for changes in the population over time.

9. SUMMARY

The discussion so far demonstrates the concept of disease surveillance, the methods commonly used, the changing needs of surveillance in different stages of programme development and some of the problems in interpretation of data.

The problems of changing population can be solved by using rates rather than absolute numbers. The problems of increasing referrals from outside the usual catchment area can be solved by keeping information on the residency status of cases. The problems of completeness of reporting can be solved by utilisation of sentinel sites. Further analysis may be done by analysing the age-specific incidence rates.

The important point to realize is that surveillance data require thoughtful analysis and simply adding up absolute numbers of cases reported from various institutions in the area may not give a true picture of disease trends in the community.

10. Conduct Investigation

There are various situations requiring investigations such as:

1. Clustering of cases/deaths in time and/or space.
2. Unusual increase in cases or deaths.
3. Unusual increase in bacteriologically proved cases even if total cases are not increased.
4. Unusual decrease in cases.
5. Even one case of AFP, plague, DHF.
6. Even one case of a disease which is not known to be present in an area.
7. Cases of measles from remote areas.
8. Shifting in age distribution of cases.
9. Patients older than 5 years of age with severe dehydration from acute diarrhoea with or without vomiting.
10. Occurrence of two or more epidemiologically linked cases of meningitis.
11. Unusual isolates.
12. High vector density.

13. Disasters.

First try to confirm the diagnosis of cases. Visit the areas from which the cases are being reported. During the visit see as many cases as possible and involve laboratory to the maximum possible extent.

11. ACTION

Action has to be taken to correct any problem uncovered during routine reporting or epidemiological investigation or a survey. If increased rates of morbidity or mortality are documented, you have the responsibility for determining the methods and feasibility required to control the situation. The purpose of investigations and analysis is thus not only to determine what happened, but also to decide how to control current outbreaks and how to prevent further attacks in the future. Action, where possible and feasible, is the logical follow up of every investigation and analysis.

12. FEEDBACK

To ensure that the reporting units at the various levels remain motivated and involved in the surveillance process, there must be regular communication back from higher levels of programme managements to lower levels. This can be done through communication in staff meeting and publication of newsletters. The list of various reporting units would show how many regular reports have been received. The number of cases reported during a particular reporting period may be compared with data of the corresponding period of previous years. The feed-back should include comments on the performance in recording and reporting of cases and suggestions in solving problems in collection of data. The feedback will keep the staff motivated by helping them to understand that the information they collect is important.

The newsletter should be sent not only to reporting units but also to all involved in the programme.

Other method of feedback can be discussion of reports during routine visits to the health centres.

Exercise 12

- Now you have understood all the steps to surveillance. Can you design an ideal surveillance system for viral hepatitis in your district?

- Under what circumstances you will like to get the assistance from other agencies for investigation of an epidemic.

Teaching module No. 2

OUTBREAK INVESTIGATION & CONTROL MODULE

National Disease Surveillance Programme
Directorate of Health & F. W. Services
Bangalore-560 009, Govt. of Karnataka

OUTBREAK

INVESTIGATION & CONTROL

MODULE

NATIONAL INSTITUTE OF COMMUNICABLE DISEASES
(DIRECTORATE GENERAL OF HEALTH SERVICES)
22-SHAM NATH MARG, DELHI - 110 054

1998

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1. NEED FOR OUTBREAK INVESTIGATIONS

1.1. Many communicable diseases are endemic in India. An effective surveillance system is essential for planning, implementation and monitoring the disease control programmes. Many of these diseases have seasonal and cyclic trends which can be discerned through the surveillance system. These diseases can also cause outbreaks with the potential to spread rapidly and cause many deaths. Outbreaks of new and reemerging infections may also occur.

1.2. Precautionary measures taken in anticipation of an outbreak can prevent an acute public health emergency and save lives. While outbreaks cannot always be predicted or prevented, recognition of early warning signals, timely investigations and application of specific control measures can limit the spread of the outbreak and prevent deaths. Control measures are most effective when selective interventions are applied early.

1.3. The primary purpose of an outbreak investigation is to control the outbreak, limit its spread to other areas and assess how prevention strategies can be further strengthened to reduce or eliminate the risk of such outbreaks in the future.

2. PREPAREDNESS FOR OUTBREAK INVESTIGATIONS AND CONTROL

2.1. This document has been designed to help in making decisions regarding investigations, specific interventions and follow-up measures. While adaptations may be necessary at local levels depending on the field situations and available resources, it is important that preparatory action is taken so that the district is able to meet the eventualities if an outbreak occurs. Some of the recommended measures are given in the Box.

RECOMMENDED PREPARATORY ACTION
• Identify a nodal officer at the state and district levels. • Strengthen the routine surveillance system. • Constitute an inter-disciplinary team at state/district levels (rapid response team). • Train medical and other health personnel. • List the laboratories at regional /state/district level. • List 'high-risk' pockets in the rural / urban area. • Establish a rapid communication network. • Undertake IEC activities for community participation. • Ensure that essential supplies are available at the peripheral health facilities and buffer stocks are maintained at the district level. • Set-up an inter-departmental committee, including NGOs.

2.2. The identification of a nodal officer at the state and district levels is important for receiving information about unusual events and for ensuring that necessary follow-up action is taken in a timely and effective manner.

2.3. An inter-disciplinary expert team at state and district levels (rapid response team) comprising of epidemiologist or public health specialist, microbiologist, clinician(s), entomologist and concerned programme officer should be constituted and necessary administrative orders issued authorizing the team to move quickly to the site of the outbreak if such a request is made by the nodal officer. This is particularly important in the event of an unusual outbreak for which the services of the expert team may be required at short notice.

2.4. Concerned medical and health personnel should be trained in the principles of outbreak investigations including recognition of early warning signals, epidemiological and entomological parameters, differential diagnosis, laboratory support and specific control interventions.

2.5. Some laboratory tests are expected to be done at the PHC level; others may be available only at the district level. For some laboratory tests, samples may need to be sent to the state, regional or national levels. A list of the laboratories with full address, telephone and fax numbers along with the type of tests conducted is recommended to be maintained. The nodal officer should identify gaps in laboratory services at each level that can be filled within the given resources. Special emphasis must be placed on proper collection of clinical samples, their storage and transportation. A suggested checklist of services at district level is given at Annex 1.

2.6. An effective surveillance system must be established in each district. Data should be regularly analyzed as suggested in a separate module **"Surveillance of Epidemic Prone Diseases"** available from National Institute of Communicable Diseases (NICD), 22-Shamnath Marg, Delhi-110054; Phone:2521272, 2521060; FAX: 2922677; (E-mail:dir-nicd@x400.nicgw.nic.in, OR jotnas@del2.vsnl.net.in) Early warning signals will be missed in the absence of a reliable surveillance system.

2.7. It is important that adequate facilities are established at the district level for rapid and efficient analysis of the surveillance data. The nodal officer and other key personnel should receive training in the use of computers. Software such as EPI INFO are particularly useful in maintaining and analyzing line lists of cases of various diseases. Such analysis provides valuable epidemiological information regarding high risk groups, areas and factors.

2.8. In each district there are likely to be some areas which will be at a higher risk of outbreaks because of inadequate facilities such as water supply, poor sanitation, or some areas may have poor transportation and communication facilities which may impact negatively on early notification of an outbreak and health seeking behavior of the community. Spot maps of these areas may be prepared so that special attention could be given to the surveillance reports from these areas.

2.9. In the event of an outbreak, the state nodal officer is required to be notified immediately. The district officers may also need technical and other support in the event of an unusual outbreak or if the diagnosis is not confirmed. Since the National Institute of Communicable Diseases (NICD) is the nodal office at the national level, it is expected that notification of the outbreak would be made immediately to NICD, also indicating if any technical support is required. It is obvious that the communication network must be rapid in order to optimize its effectiveness. Under the national disease surveillance programme, it is expected that the district and state levels will be linked to NICD through e-mail and fax. Telephone facilities are expected at the PHC level.

2.10. The prevention and control of outbreaks require the close and active cooperation of the community. Community level IEC activities should be supported so that key messages regarding the control of the diseases and prevention of outbreaks are known. Health education material which has been prepared in advance and field tested will be useful if there is an outbreak in the area because such material may be required at short notice. The medical and health personnel should establish contact with community leaders and other key personnel in their areas which would be useful in receiving early warning signals and in soliciting community support during an outbreak. Local private practitioners could provide valuable support.

2.11. The nodal officer at the district level, in consultation with the concerned programme officers, must ensure that essential supplies are in place in the peripheral health facilities and that adequate buffer stocks are maintained at the district level. Inventories should be checked before the expected seasonal increase of cases. Some life saving medicines such as ORS packets may also be kept at the village level especially in the high risk pockets and areas which might become inaccessible during the monsoons.

2.12. It should be noted that during an outbreak a higher percentage of more severe cases may occur. Case fatality rate may increase due to certain factors such as high malnutrition rates in young children or

limited knowledge in the community about the danger signs of severe illness. Precautionary measures need to be taken and decided where and when to seek medical help in a timely manner. For example, post measles pneumonia kills many children. Mother must consult the health facilities whenever signs and symptoms of pneumonia appear for proper treatment of cases. It will only be possible if mothers know about signs and symptoms of pneumonia i.e. increased respiratory rate and chest indrawing.

2.13. When an outbreak occurs or when the risk of such outbreaks is high, the cooperation of other government departments, non-governmental agencies and the community often becomes necessary. Such help will be more forthcoming if mechanisms for interaction have been developed before the onset of an outbreak. It might be useful to convene a meeting of the concerned departments, community representatives and the NGOs before the expected seasonal increase in cases of diseases. Some mechanism for briefing the press should also be established. Some suggested areas in which the government departments and NGOs can assist may be seen at Annex 2.

2.14 Detailed demographic, environmental and cultural profile of district (including maps) should be available.

3. DISEASES REQUIRING INVESTIGATIONS

3.1. The diseases discussed in this document can broadly be classified into the four following groups:

- endemic diseases with the potential of causing focal or large outbreaks, e.g. malaria, cholera, measles, viral hepatitis, meningococcal meningitis etc.
- diseases for which eradication or elimination goals have been set. A single case of such diseases should be treated as an outbreak, e.g. poliomyelitis, guinea worm and yaws
- rare but internationally important diseases with high case fatality rates with the potential of importation due to conducive epidemiological conditions, e.g. yellow fever
- outbreaks of unknown aetiology

4. DEFINITION OF AN OUTBREAK

4.1. **An outbreak or epidemic is defined as the occurrence in a community of cases of an illness clearly in excess of expected numbers.** While an outbreak is usually limited to a small focal area, an epidemic covers larger geographic areas and has more than one focal point.

4.2 The number of cases which are needed to be called an outbreak varies according to several factors. It depends on past historical patterns of the disease, case fatality and complication rates, and potential of spread to other areas. For some diseases even a single case (acute poliomyelitis, guinea worm, unusual acute severe episode of an illness of unknown aetiology) constitutes an outbreak.

4.3 States and districts should establish criteria on the number of cases that constitute an epidemic based on their local situations. For example, 5 cases of similar illness of acute onset within an incubation period or one death in a village is being used as a criteria in one state to constitute an outbreak.

4.4 Increase in the total number of cases does not, however, necessarily indicate increase in the incidence of the disease. Variations in the number of reporting sites, completeness of reporting, geographical size of the catchment area and size of the population are factors that must be taken into consideration while analysing reports.

5. TRIGGER EVENTS (WARNING SIGNALS) FOR OUTBREAK INVESTIGATIONS

SUGGESTED TRIGGER EVENTS FOR OUTBREAK INVESTIGATIONS
• clustering of cases or deaths in time and/or space
• unusual increase in cases or deaths
• acute haemorrhagic fever
• severe dehydration following diarrohoea (usually with vomiting) in patients >5 years of age
• acute fever with altered sensorium
• acute fever with renal involvement
• acute flaccid paralysis in a child
• acute fever with painful lymphnode
• acute febrile severe illness of unknown aetiology
• occurrence of two or more epidemiologically linked cases of meningitis
• even a single case of measles or any other epidemic prone diseases from a tribal or other poorly accessible area
• unusual isolate
• shifting in age distribution of cases
• high vector density
• natural disasters

5.1. It is useful to have a short list of 'warning signals' which should trigger an investigation. If personnel at the local levels are alert about these signals and respond rapidly, it may be possible to arrest the outbreak in the early stages when control measures are most effective and can usually be undertaken within local resources.

5.2. An important purpose of a surveillance system is to prevent outbreaks or detect them in the early stage, and therefore the health personnel must be responsive to the warning signals. Some suggested trigger events are listed below in the Box.

6. INVESTIGATIONS AND ANALYSIS OF REPORTS

6.1 Verification of the Diagnosis

6.1.1 **The first step of outbreak investigation is to confirm the diagnosis of as many reported cases as possible**. Much time and effort may be wasted due to misdiagnosis. The reported cases should be investigated by a medical officer to confirm the diagnosis. The majority of the cases are expected to fall within the standard case definitions. In situations of doubt, whether an illness meets the case definition, a second opinion may be sought.

6.1.2 First reports about an outbreak will be based on clinical syndrome and diagnosis will be presumptive. Suggestions have been made for clinical syndromes, outbreaks of which are more commonly reported. Investigations must be made, including epidemiological, entomological and laboratory, to rule out the more common causes first. A thorough knowledge about clinical symptoms and epidemiological parameters is important for outbreak investigations.

6.1.3 Laboratory confirmation of clinically-diagnosed cases or identification of the etiological agent may sometimes be necessary. Under such a situation, samples should be collected carefully from a few selected cases. It is not necessary to collect specimen from all cases as it is not essential for the outcome of outbreak investigations and control measures. Collection of unnecessary samples is discouraged as it places a heavy load on the laboratory and some tests are very expensive. The types of tests, sample collection and transportation procedures have been detailed in a separate module.

It is not necessary to collect specimen from all cases as it is not essential for the outcome of outbreak investigations and control measures. Collection of unnecessary samples is discouraged as it places a heavy load on the laboratory and some tests are very expensive.

6.1.4 If the outbreak is unusual, case fatality rates are very high, aetiology cannot be determined or if the clinical syndrome had not been reported in the area before, the state officer and NICD would be expected to assist the district authorities in investigations.

6.2 *Epidemiological Features and Standard Case Definitions*

6.2.1. It is necessary to know the clinical and epidemiological features of the diseases to effectively investigate and control outbreaks. For easy reference, the epidemiological parameters should be available in tabular form.

6.2.2. Differential diagnosis of some of the important and common clinical syndromes have been given in this document. Medical officers are encouraged to expand the list and include other conditions prevalent in their areas.

6.2.3. Standard case definitions are summarised in a separate module **"Case Definitions of Epidemic Prone Diseases"** available from NICD.

6.3 *Criteria for Investigating an Outbreak*

6.3.1. Oubreaks should be seen as excellent opportunities to analyse why they occur, identify high risk areas and groups, and evaluate control measures. Efforts therefore, should be made to investigate all the outbreaks as well as threatened oubreaks.

6.3.2. After an outbreak has been confirmed, specific interventions will depend on the cause of the outbreak and mode of transmission. Timely treatment and follow-up of cases and contacts is important to reduce mortality.

6.4 *Case-Finding Through Active Surveillance and Community Surveys*

6.4.1. After establishing the existence of an outbreak and verifying the diagnosis, it becomes important to accurately define and count the cases. During the period of the outbreak, all the cases of the disease under consideration occurring in that area should be identified and listed.

6.4.2. Active surveillance is active search for cases. This may include visits or telephone calls to the medical facilities or private practitioners that might expect to admit or attend cases of the disease. Active surveillance through peripheral health personnel, personnel from other government departments, NGOs and key community representatives provides additional information about cases who may not have been seen at government health facilities. Valuable information can be obtained by contacting key community representatives, especially if the outbreak is focal. Such information is useful in defining the extent of the outbreak.

6.4.3. Active surveillance should be maintained until the outbreak is over (usually it is when the double incubation period has elapsed after the last case). Developing a regular schedule of daily or weekly visits (depending on the urgency of the situation) or telephone calls to concerned institutions or individuals will help maintain the flow of surveillance information to those analysing the outbreak and directing control activities.

6.4.4. Suspect case definition may be used to identify cases. While it is recognised that there may be some over-reporting of cases, it is nonetheless important that no case is missed, especially if treatment is available. Some of the epidemic prone diseases are amenable to simple and cost effective treatment and case fatality rates are usually less than 1% if such treatment is applied early during the course of the illness (for example, in cholera). In the absence of specific treatment, mortality rates can be very high.

6.4.5. Depending on the disease and the resources available to investigate the outbreak, it may even be desirable to conduct house-to-house visits, especially in the homes of contacts of cases. In some circumstances, community assistance may be enlisted for house-to-house visits.

6.4.6. Completeness of reporting and relevant information on majority of cases are important for determining high risk factors, complications and mortality rates and health seeking behaviour as well as to further understand the clinical pattern and epidemiology of the disease. The information is also necessary to assess the quality of the national programmes (if relevant).

6.5 Line-Listing, Defining and Counting of Cases

6.5.1. It is important that information from surveillance be recorded in a standardised manner. Persons who are ill and meet the case definition for the outbreak disease should be entered onto what is called a "line-listing". This is a list of all reported cases with the relevant data on each case which provides the basis for counting of cases. It is the data-base on which the descriptive epidemiology of the outbreak can be made and it can serve as the basis for other, more sophisticated, analytical epidemiological studies, such as risk-factor analysis, vaccine efficacy, etc. The line list suggested for field use is shown in Annex-3.

6.6 Description of Outbreak

In investigating an outbreak, it is necessary to provide a detailed description of outbreaks in terms of time, place and person.

6.6.1. Distribution by time

The onset of illness of the cases should be graphed by hours (for example, in food poisoning), days, weeks or months, as appropriate. This type of graph is commonly referred to as an epidemic curve. The epidemic curve can be helpful in identifying the index (first) case or cases, and may even suggest patterns or modes of transmission. During outbreaks, analysis of cases by time will help to document the trend of the epidemic and to monitor the effectiveness of the containment measures.

In case of endemic diseases, it is also useful to present previous data on a line graph. Such graphs help to demonstrate the magnitude of the outbreak compared to the previous reported incidence, rapidity of spread of the disease and evaluation of control efforts.

6.6.2. Distribution by place

A map of the area or even a rough sketch can be drawn showing where each reported case resides to indicate geographical distribution of cases and to identify high risk pockets. In some situations, serial spot maps, by week or by month (or by disease generation) may provide insight into the pattern of the spread of the disease over time.

Cases tend to cluster, and it may also be useful to mark affected schools or other institutions on the map in addition to residential locations. Such mappings may assist in identifying the sources of infection.

6.6.3. Distribution by person

Cases should be described in terms of age, sex, occupation, socio-economic parameters, migration, vaccination history and other relevant characteristics.

It is usually sufficient to group cases by age-groups by 0-11 months, 1-4 years, 5-14 years, 15-44 years and $\geq$ 45 years. However, in the case of vaccine preventable disease outbreaks which usually affect young children, grouping with smaller intervals will be needed such as <1 year, 12-23 months, 24-59 months, 5-9 years, 10-14 years and $\geq$ 15 years.

While preparing tables, the population characteristics, for example related to age and sex, should be grouped accordingly. While

calculating the age-specific attack, complication or mortality rates, the proportion of the age group under study to total population should be taken into account while calculating rates.

6.7. Description of environmental conditions

The study of environmental conditions and the dynamics of its interaction with the population and causative agents will help in the formulation of hypothesis on genesis of the epidemic, which will make the basis for the control measures to be taken. With respect to physical environment, the data on rainfall, humidity and temperature are available in the district meteorological centres. Information on natural disasters like floods, cyclone, drought, earth quake etc., as available may be utilised for the description of the epidemic. Man made situation like developmental projects on irrigation and industries may create environmental conditions conducive for disease transmission. Similarly information on drinking water supply and environmental sanitation is crucial for the investigation.

6.8. Additional steps during investigation of outbreaks of vaccine preventable diseases

6.8.1. The determination of Immunization coverage levels is crucial if the outbreak is due to a vaccine preventable disease. The Immunization status in the community can be assessed through Immunization performance records available at the PHC. Percentage Immunization coverage is estimated by dividing the total number of doses (measles and BCG) or third doses (OPV and DPT) of the vaccine administered to a specific age-group by the total population of that age-group in the affected village(s) or urban area. The data may be summarised for example for OPV as shown below.

Reported vaccination coverage for OPV

Year	Population	Estimated No. of infants	Vaccination performance					Percent coverage*
			0 dose	1 dose	2 doses	3 doses	Booster	

* Percent coverage = No. given 3 doses x 100 / Estimated number of infants

6.8.2. The age-groups vaccinated should be fully assessed as inclusion of older children may give a false sense of higher coverage. The immunization activities, including periodicity of the immunization

sessions, quantities of vaccines received and cold chain system, should be reviewed.

6.8.3. Information on immunization coverage may also be available through past vaccination coverage evaluation surveys. If no such coverage evaluation survey has been performed recently, or if estimates of immunization coverage by reports of doses administered are unavailable or suspect, (a large number of vaccinations may be given by the private sector and are not reported) then it may be useful to conduct a coverage evaluation survey as a part of the outbreak investigation which may also be used to estimate vaccine effectiveness.

6.8.4. Immunization status is an important descriptive as well as analytical parameter. The immunization status of each case must be carefully investigated to ascertain the number of doses of the vaccine received by the patient. Immunization cards or immunization registers should be checked to verify the immunization status. Verbal history should be used only if such records cannot be obtained. Ideally, the place of immunization should also be examined to assess quality of the cold chain.

6.9. Laboratory investigations

6.9.1. The results of laboratory investigations should be included in the outbreak investigation report. Results of some tests can be obtained locally and quickly. Such tests include water quality monitoring if a water-borne disease is suspected.

6.9.2. Control activities and treatment of patients should not be delayed pending laboratory confirmation of diagnosis. Action should be initiated based on clinical, epidemiological and entomological findings.

6.9.3. Special emphasis must be placed on proper collection, labelling transportation and storage of clinical samples.

6.9.4 It is not necessary while submitting the preliminary report to wait for the results of laboratory tests which have been sent to laboratories outside the district and which may take sometime. The results can be added in the final report.

6.9.5 During the course of investigations, universal infection control precautions are expected to be implemented. While investigating outbreaks of haemorrahagic fever or if parenteral route of transmission is suspected, protective gear such as gloves, masks etc. are expected to be worn by health personnel treating or investigating patients. Procedures that require the collection of blood and other clinical samples should be undertaken carefully.

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6.10. Entomological investigations

6.10.1. Entomological investigations are an important aspect of field investigations as a number of outbreaks are vector borne. Entomological investigations are useful to confirm or rule out the probable cause of the outbreak, especially if results of laboratory tests are not available.

6.10.2. High vector density is a reflection of the unsatisfactory field implementation and monitoring of vector control measures. High vector density is a warning signal as the risk of vector borne outbreaks increases under such conditions. On the other hand, the risk is low if the density is maintained below critical levels.

6.10.3. If dengue fever/ dengue haemorrahagic fever is suspected or confirmed, vector surveillance and vector control activities should be taken up with high priority. Vector surveillance should be immediately undertaken in other high risk pockets even if no case has been reported from the area.

6.11. Determining Who is at Risk of Disease

6.11.1. The descriptive epidemiology will help to define the population groups at high risk of disease in terms of age-groups, geographical location, activity etc., immunisation status and other characteristics.

6.11.2. It is more appropriate to determine attack rates rather than absolute numbers because rates take into account the variations in the population size of different groups. Such rates are generally computed by dividing the number of cases in a population group by the population size of the same group.

Example: There are 45 cases of measles among 1100 children less than 5 years of age and 52 cases in 3400 children 5-14 years of age in the affected town.

Attack rate = 45/1100 = 0.04 or 40 cases per 1 000 population less than 5 years of age

Attack rate = 52/3400 = 0.015 or 15 cases per 1 000 population 5-14 years of age

6.12. Follow-up Visits

6.12.1. Follow-up visits to the community and health facilities are important during the declining phase of the outbreak to (i) not to miss

7.3. It is particularly important to inform the public that most cases of epidemic prone diseases can be managed if treatment is started at the earliest.

7.4. It is also important that the public and administrators are aware of inappropriate measures so that much time and resources are not diverted for measures which are ineffective. These include vaccination and chemoprophylaxis for cholera and quarantine measures for most infections.

8. PREVENTION AND CONTROL OF AN OUTBREAK

8.1. Water borne outbreaks

8.1.1. The risk of outbreaks of water-borne diseases such as cholera, acute watery diarrhoea, viral hepatitis, shigellosis and typhoid fever can be minimized and an outbreak can be prevented from spreading further by taking following measures:

- provision of safe water
- adopting safe practices in food handling
- frequent handwashing
- sanitary disposal of human waste

8.1.2. The above steps are required both as long-term measures to prevent cholera and other water borne diseases as well as measures to be taken in a focal area where an outbreak is anticipated. Community participation for safe practices with regard to storing water and food handling are essential to prevent outbreaks.

INEFFECTIVE MEASURES FOR CHOLERA

- chemoprophylaxis
- vaccination against cholera
- travel and trade restrictions (*cordon sanitaire*)

8.1.3. Mass chemoprophylaxis is not only ineffective in preventing the spread of the disease, but it also diverts manpower and resources from effective measures. In several countries, it has contributed to the emergence of antibiotic resistance, depriving severely ill patients from a valuable treatment. The value of selective chemotherapy of household contacts is also doubtful. It is not recommended as a routine measure.

8.1.4. Vaccines that are currently available against cholera do not have high vaccine efficacy rates. In those who are immunized with two doses, protection lasts for 3-6 months only. Vaccination does not reduce the incidence of asymptomatic infections or prevent the spread

last cases, (ii) detect and treat later complications, for example, in measles (iii) evaluate the control strategy and (iv) complete the documentation of the outbreak.

6.12.2. The frequency and duration of follow-up visits will depend on many factors and decisions will have to be taken at the local level. The factors that will influence decision will be the severity of the disease, its potential for spread to other areas, maximum incubation period and the accessibility of the affected area to routine health services.

6.13. Documentation

6.13.1. Documentation of the epidemic is an important step in outbreak investigation. Useful lessons can be learnt if the documentation is complete and data properly analysed. The information will be useful in drawing up long term strategies for reducing the risk of the outbreaks in future and in more effective handling of the outbreak if it were to occur. A suggested format for final report is given in at Annex-4.

6.13.2. It is also important that the report is shared with the concerned officers of other states and districts.

6.13.3. Publication of the report in a technical journal or newsletter will ensure wider accessibility to the information.

6.13.4. The main findings of the outbreak should also be discussed with the members of the rapid response team and the members of the inter-departmental committee.

7. HEALTH EDUCATION

7.1. Health education and public awareness and co-operation are important to control an outbreak. If the community knows how the outbreak spreads and what measures they can take in their own families, the risks can be considerably reduced. It is also important that the public should know if treatment is available and where to seek medical help. If such information is available there is less likely to be panic and chaos, and community support will also be forthcoming. While the key messages will essentially remain the same for all areas, the language and style may need to be adapted to local needs.

7.2. It is suggested that action for preparation of health education material and key messages is taken for epidemic prone diseases. Some suggestions to develop the key messages are given in the documents on specific diseases.

8.3 *Food-borne outbreaks*

8.3.1 Food-borne diseases include food poisoning due to toxins produced by micro-organisms (e.g. *Staphylococcus aureus*) and chemicals, as well as food-borne infections (e.g. Salmonella infection). In fact, all the waterborne infections (viral, bacterial and parasitic) can be transmitted through contamination of food. Food-borne outbreaks are very common in our country. Whereas in the past contaminated food processed in the home exposed a few individuals, the food processed and distributed extensively by the industry could result in the exposure of a large number of people.

8.3.2 While investigating an outbreak of food-borne infection, efforts should be made to interview all who are exposed for history of food consumption and illness, if any. Rates of illness in those who did or did not consume a specific food item are compared, and relative risk is calculated for each food item. The implicated food would give the highest attack rates, and/or the highest relative risk. In large outbreaks, a sample of population may be interviewed, or the investigations may be by case control studies. Food handlers and suspected food also need attention during investigations.

8.4 *Air-borne outbreaks*

The important air-borne diseases those can cause outbreaks are measles, diphtheria, whooping cough, chickenpox, meningococcal meningitis, and influenza. The first three diseases are vaccine preventable and their outbreaks reflect poor immunisation activity in the community. For influenza and chickenpox, no vaccine is currently available in India and in absence of specific therapy, control of their outbreaks is a difficult proposition. Chickenpox in higher age group is often serious and large number of patients need to be admitted in health facility, particularly Infectious Diseases Hospitals. In case of meningococcal meningitis, though a bivalent vaccine is available, it is not routinely used. In outbreak of meningococcal meningitis, vaccination of selected high risk groups only is recommended. Since specific and effective treatment of this disease is available, early diagnosis and initiation of specific treatment can cut down the mortality substantially.

The general principles of control of outbreaks of air-borne diseases are: respiratory hygiene, avoidance of over-crowding, maintenance of good ventilation, IEC for early recognition, chemoprophylaxis (for meningococcal meningitis) and immunisation (for vaccine preventable diseases).

of infection. Vaccination campaigns divert resources and manpower from more useful control activities. ***No country requires travelers to have a cholera vaccination certificate.***

8.1.5. Travel and trade restrictions between countries or different areas within a country do not prevent the spread of cholera. Majority of the infected individuals have no symptoms. Setting up check-posts requires massive inputs and diverts attention from other more useful control measures.

8.1.6. An important objective of outbreak investigations is to reduce mortality rates by early diagnosis and appropriate treatment. Case fatality rates can be significantly reduced through effective Oral Re-hydration (ORT) therapy.

8.2 Vector borne outbreaks

8.2.1. Vector control measures should be applied as per the calendar of activities to optimize impact for prevention of outbreaks. The control measures should be directed towards all stages of the life cycle of the vector.

8.2.2. The risk of vector borne diseases has increased in the urban and peri-urban areas due to the changing life styles and industrial activities which have made the surrounding environment more conducive for the breeding of mosquitoes and other vectors.

8.2.3. The *Aedes* mosquito (vector for dengue fever) is a domestic breeder preferring clean water containers. The cooperation of the community is imperative to control mosquito breeding by taking simple precautionary measures. Regular monitoring is essential to ensure that breeding sites are eliminated in a timely manner.

8.2.4. The risk of some vector borne outbreaks increases in the presence of animals or birds. For examples, pigs are considered to be amplifying hosts of Japanese Encephalitis virus. Where piggeries have been established, regular monitoring and periodic anti-vector measures are indicated. The local pradhan and panchayat members should be aware that if there is an acute case of fever with altered sensorium, the local health authorities should be notified immediately.

8.2.5. Bubonic plague and visceral leishmaniasis are other important vector borne diseases. In areas where leishmaniasis is prevalent or there is a potential threat of leishmaniasis or plague, vector monitoring and IEC activities are recommended.

8.5 Parenterally transmitted infections

Injections can transmit a variety of infections including HIV and hepatitis B and C. Inadequately sterilised needles and syringes, sharp instruments that penetrate the skin, and unscreened blood are common source of parenterally transmitted infections. Appropriate sterilisation of needles (boiling for at least 20 minutes) and screening of all blood donations for HBsAg, HIV, VDRL and malarial parasites will go a long way in preventing these infections.

9. PRECAUTIONARY ACTION IN HIGH RISK POCKETS TO WHICH THE OUTBREAK CAN POTENTIALLY SPREAD

Following actions are suggested:

9.1. Alert health personnel and hospitals to report increase or clustering of cases or deaths. All health facilities should maintain records of patients seen, including in OPD. Address of the patients should be recorded. If there is a sudden increase in cases or clustering of cases in an area, field investigations should be carried out and necessary corrective action taken. An effective surveillance system can provide an early warning signal and prevent outbreaks.

9.2. Ensure that the health personnel are adequately trained and that the recommended guidelines are followed in the hospitals. If necessary, orientation sessions or retraining may be organized. Early and appropriate treatment can save many lives.

9.3. Arrange random checks for water quality for coliform organisms (faecal contamination). Special attention may be given to high risk pockets. In places where water is found to be of unsatisfactory quality, follow-up action may be taken with the concerned authorities for water supply. If feasible, chlorination should be carried out to render water safe for drinking.

9.4. Health educational activities should be carried out in the community to promote safe practices especially before the monsoons when the seasonal increase of cases of water and vector borne diseases can be expected.

9.5. Check that adequate stocks of essential supplies are available and have been distributed to the peripheral health institutions well in advance of the expected seasonal increase of cases, for example, ORS packets should be available in all the health facilities. It is recommended that adequate stocks of bleaching powder, chlorine tablets, intravenous fluids, appropriate antibiotics and insecticides are available in case of an emergency.

10. SYNDROMIC PRESENTATION OF DISEASES

10.1. Common syndromes

The monitoring of early warning signals and first reports will be syndromic and diagnosis will be presumptive. These may include acute cases of:

- fever
- haemorrahagic fever
- fever with altered sensorium
- diarrhoeal diseases
- jaundice
- flaccid paralysis
- severe illness of unknown aetiology.

10.2. Acute cases of fever

10.2.1. Clustering and sudden increase of acute cases of fever may be due to malaria, dengue fever or other viral fevers. If the increase meets the criteria of an outbreak, necessary clinical, epidemiological, laboratory and entomological investigations must be conducted to confirm diagnosis.

10.2.2. Fever with rash may be due to measles or chicken pox. Diagnosis can be confirmed by typical clinical presentation, age group affected and vaccination history (measles).

10.2.3. Acute fever are caused by a variety of viruses. The type of virus can be identified only by laboratory tests. However, the type of clinical presentation and other epidemiological and entomological parameters may help in presumptive diagnosis. Some of the diseases such as dengue fever may present in severe form such as haemorrahagic fever and shock syndrome. The report of even a single case of haemorrahagic fever from an area which has a reported increase of acute fever cases compatible with dengue fever as well as a high density of *Aedes aegypti* is a strong indication in favour of dengue fever.

10.2.4. Malaria is relatively common in our country. Any increase in cases of acute fever from an area which has other conditions conducive for the spread of malaria, requires that malaria is considered as the cause of the outbreak.

10.2.5. Increase in the acute fever cases may be due to typhoid fever [illegible] relatively common in many parts of the country. Patients

should be examined to see if the clinical presentation is compatible with the case definition of typhoid fever.

10.3. Haemorrhagic fever

10.3.1 Cases of haemorrahagic fever are expected to be relatively rare and few in number. It is therefore very important that notification by the clinicians is made immediately by the fastest means of communications. Investigation of the case of haemorrahagic fever may identify a dengue fever outbreak. If a clustering of acute fever cases have been reported and dengue fever is suspected on clinical grounds and entomological investigations, a reported case of haemorrahagic fever from the area will clinch diagnosis.

10.3.2. Haemorrhagic fever can also be caused by chikungunya virus. The disease is clinically indistinguishable from dengue fever. However, cases of shock syndrome have not been reported and case fatality rates are low.

10.3.3. Severe forms of haemorrahagic fever with high case fatality rates due to yellow fever and ebola fever have been reported from some countries. There has been no report from India. Due to rapid means of transport and increase in the number of travellers, there is a potential risk of importation of these infections. Travel history or close contact with those who have recently traveled abroad should be obtained if the above infections are suspected. **State and national authorities must be notified immediately by the fastest routes of communication.** Infection control precautions must be practiced while investigating or treating patients, and handling infectious biological material.

10.4. Fever with altered sensorium

10.4.1. JE infection is usually mild with no overt clinical symptoms or mild fever with headache. However, the patient may present with signs of encephalopathy. Usually not more than a few such cases (1-2) occur in one village. These patients will give a history of acute onset with fever and change in behavior or sensorium lasting for more than 24 hours. Focal neurological deficits may or may not be present. Disturbances of sensorium are reflected as lethargy, somnolence, irritability, apathy or loss of consciousness. The patient may develop difficulty of speech and other neurological deficits like ocular palsies, hemiplegia, tremor and ataxia. There may also be loss of bladder and bowel control. The focal neurological signs may be stationary or progressive. In majority of the cases, individuals develop immunity after infection. In endemic areas cases are, therefore, seen more often in children under 15 years of age as the adult population is already immune through natural infection. In virgin areas, cases may be seen in all age groups. Patient should be

hospitalized immediately to reduce mortality rates. Cases are confirmed by serology for JE antibodies (demonstratin of IgM antibodies or four fold rise in IgG antibodies in paired serum samples). Isolation of virus from CSF or brain tissue is not routinely done.

10.4.2. A case of meningitis usually presents with sudden onset of high grade fever, severe headache, stiff neck with or without altered sensorium. Presence of nuchal rigidity and positive Kerning and Brudzinski signs confirm the clinical diagnosis. Meningitis may occur due to tubercular, viral or pyogenic organisms. A lumber puncture for demonstration and/or isolation of organisms from CSF is essential. A commercially available latex agglutination test may provide the aetiology of some agents of meningitis i.e. *Streptococcus pneumoniae, Haemophilus influenzae B, Meningococci A&C.* It is noteworthy that meningococcal meningitis may occur in epidemic form.

10.4.3. One of the complications of malaria caused by *P.falciparum* is encephalopathy. Since malaria is relatively common, the diagnosis of malaria should be first considered. The diagnosis is confirmed if field investigations indicate malariogenic conditions, illness is clinically compatible and anti-malaria treatment is effective. The facilities for making blood slides and examining them should be available at each PHC.

10.4.4. Typhoid fever is usually characterized by gradual onset of malaise, lethargy, headache, myalgia, loss of appetite and fever that increases in stepwise fashion to reach 39-41° C in 5-7 days period. A mental apathy and dullness is common and delirium may develop. At this stage patient may present as fever with altered sensorium. Since typhoid fever is very common in our country, it should always be excluded by careful history, physical examination and blood culture for *S.typhi.*

10.4.5. Fever with altered sensorium (encephalopathy) may occur as a result of complication of some diseases such as malaria, dengue fever, measles and pertussis. Such complications occur in a relatively small proportion of the cases. Even a single case of encephalopathy therefore reflects a relatively large number of cases of the disease in the community. It is probable that clustering of cases of acute fever have already been documented through the routine surveillance system and report of a rare but well recognized and documented complicated case further confirms the cause of the outbreak. It is important that the clinicians are aware of the need to report such cases immediately so that further field investigations could be carried out.

10.4.6. Tuberculous meningitis is relatively common in many parts of our country. Although large number of cases are reported, TB

meningitis is not expected to occur in the form of explosive outbreaks. Clinicians must, however, keep in mind TB meningitis as a differential diagnosis, especially if the patient is a young child.

10.4.7. If any case of encephalopathy due to unknown aetiology occurs in an area not known for JE, it should be reported immediately to the state health authorities for appropriate investigations. Since samples for virus isolation need special handling, it is appropriate that specialised institutions such as NICD and NIV are also involved in the investigations in the early stages.

10.5. Acute cases of diarrhoeal diseases

10.5.1. Water borne and food borne diseases can present with a variety of clinical symptoms. Acute watery diarrhoea in young children is the most common problem. Cases occur throughout the year, with a seasonal increase in the monsoon and post-monsoon months. Focal outbreaks of acute watery diarrhoea can occur. Such outbreaks have also been reported following outbreaks of measles. Prompt action is important to check the spread of the outbreak and to provide oral rehydration therapy which is life saving. In the absence of ORT, high mortality rates have been recorded. Death may occur within a few hours of severe episodes of acute watery diarrhoea. The younger the age group, the more susceptible they are to dehydration.

10.5.2. While diarrhoeal episodes may also occur in adults, these usually do not result in severe dehydration or death. If cases of severe dehydration or death following acute watery diarrhoea is reported in patients older than 5 years of age, cholera should be suspected and control measures at the field level should be initiated as per guidelines.

10.5.3. Outbreaks of dysentery can occur in children. Such outbreaks have the potential of causing a large number of deaths unless specific treatment is initiated in a timely manner. It is important that the community and the peripheral health personnel are aware of the danger sign of blood in the stools (bloody diarrhoea) so that medical help is sought immediately.

SYNDROMIC PRESENTATION OF DISEASES

Acute fever

malaria
dengue fever
measles
influenza
other viral infections
plague
typhoid fever

Haemorrhagic Fever

dengue haemorrahagic fever
leptospirosis
chikungunya fever
yellow fever, ebola, hanta, lassa fever (potentially importable infections) **

Acute Fever with Altered Sensorium

falciparum malaria
japanese encephalitis
meningococcal meningitis
other meningitis (pyogenic, viral)
post measles encephalopathy *
pertussis encephalopathy *

Acute Diarrhoeal Diseases

acute watery diarrhoea in young children
acute watery diarrhoea in patients above 5 years of age with severe dehydration (suspected cholera)
dysentery (bloody diarrhoea)

Acute Respiratory infections (Acute pneumonia)

influenza
leptospirosis
plague
anthrax
melioidosis
hanta virus

Jaundice

hepatitis E
hepatitis B & C (if focal with high case fatality rate) *
leptospirosis
yellow fever (potentially importable) **

Acute Flaccid Paralysis

poliomyelitis

Severe Illness of Unknown Aetiology

* - relatively rare and cases may be few in number
** - not reported in India. If diagnosis is suspected, travel history and close contact with those who have recently traveled abroad should be obtained

10.6 Acute Respiratory Infections (Acute pneumonias)

10.6.1. Acute respiratory infections leading to pneumonia are major causes of morbidity and mortality in India, especially in early childhood. They can be caused by a variety of microorganisms including bacteria, viruses, fungi and parasites. Most of the pneumonias present as sporadic cases.

10.6.2. Some diseases like plague, anthrax, leptospirosis, influenza, melioidosis and hanta virus infection may result in severe outbreaks with mainly pulmonary involvement. These may affect people from all age groups. Even if a clustering of a few cases in older children and adults is noticed, investigation should be initiated promptly for impending outbreaks of these infections so that appropriate action for treatment of cases and control of outbreak is promptly taken.

10.6.3. Patients with acute pneumonia usually present with acute fever, chills, cough, chest pain, other non specific symptoms, varying degree of respiratory insufficiency, and infiltrate on chest X-ray. In addition, there may be haemoptysis and leukocytosis or leukopenia. Once pneumonia is suspected, the specific etiologic diagnosis is necessary for proper management to prevent mortality and reduce further transmission.

10.7. Jaundice

10.7.1. Although jaundice may occur due to many reasons, viral hepatitis is responsible for the majority of cases with jaundice in our country. At least 6 agents (HAV, HBV, HCV, HDV, HEV and HGV) can cause viral hepatitis.

10.7.2. Feco-orally transmitted hepatitis E virus has been responsible for virtually all the outbreaks of viral hepatitis in India. These outbreaks are invariably linked to contamination of water supply. The expression of icterus appears to increase with increasing age. There is no evidence of a chronic form. A majority of Hepatitis E cases however, occur in young adults. Secondary household cases during the outbreaks are uncommon. The case fatality rate may reach up to 20% among those infected during the 3rd trimester of pregnancy.

10.7.3. Recently, outbreaks of hepatitis B occurred in defined rural communities of Gujarat, Haryana and Rajasthan states which were epidemiologically linked to the use of unsafe injections by unqualified medical practitioners. The outbreaks were marked by high case fatality rates.

10.7.4. Acute viral hepatitis is such a sufficiently distinct clinical syndrome that it usually poses no difficulty in diagnosis. Patient develops nonspecific symptoms including malaise, weakness, anorexia, nausea, vomiting, fever, and mild pain in abdomen. Soon, jaundice and dark urine follow. The duration of jaundice is variable, but usually lasts 1-3 weeks. These is dramatic elevation of ALT and AST (≥8 times of normal), and mild elevation of alkaline phosphates (usually only 3 times of normal). However, specific types of viral hepatitis in individual patients can't be distinguished on clinical grounds. The diagnosis is done by serology.

10.7.5. Leptospirosis is emerging as an important cause of jaundice in many parts of country. The disease is usually characterized by abrupt onset of high grade fever, myalgia and conjuctivial suffusion. Rash is occasionally present. If patient present with jaundice, renal involvement and hemorrhage, leptospirosis should be strongly suspected. Meningitis, pulmonary and cardiac involvement may also be present in some cases. Unless treated promptly with antibiotics, it is marked by high case fatality rates. The diagnosis is confirmed by demonstration of rising antibodies, or isolation of leptospires from blood during acute illness and from urine after the first week.

10.8. Acute Flaccid Paralysis

10.8.1. Poliovirus infection is the most important cause of acute flaccid paralysis (AFP) in children. The possibility of polio should be considered for any case of AFP, even in areas with high OPV coverage levels and a very low incidence of poliomyelitis. The diagnosis of paralytic poliomyelitis should be discarded only after another diagnosis has been established.

10.8.2. Acute paralytic poliomyelitis is characterized by fever followed by abrupt onset of weakness or paralysis of limbs which does not progress after first 3 days. Paralysis is not present at birth and is not associated with serious injury or mental retardation. Typical findings on physical examination include: acute flaccid paralysis, muscle tenderness, no sensory loss, absent or depressed deep tendon reflexes, and asymmetrical findings. Wasting of affected muscle is a late finding. Residual paralysis after 60 days of onset of symptoms, or death or unknown follow-up in an AFP case makes the presumptive diagnosis. Isolation of wild poliovirus from AFP cases or contacts confirm the diagnosis of acute poliomyelitis.

10.8.3. Paralytic poliomyelitis is most often confused with Guillain-Barre syndrome (GBS), transverse myelitis, and traumatic paralysis due to sciatic nerve injury. Traumatic paralysis due to sciatic nerve injury following a misplaced gluteal injection can be differentiated by a careful

history and physical examination. Fever is usually absent in GBS and the paralysis is symmetrical and distal. There are global hypotonia and global absence of deep tendon reflexes. Cramps, tingling sensation, and hypo-anesthesia of palms and soles are usually present in GBS. Many cases of polio have initially been diagnosed as GBS even by experts. Accordingly, WHO recommends that stool specimens should be tested for poliovirus on all cases of GBS less than 5 years of age.

Exercise 1

Koraput district was reported to be affected by an "outbreak" of acute gastroenteritis (GE) in July-August, 1991. About 2270 cases and 413 deaths occurred during this period. Most of the cases had only diarrhoea and vomiting.

Q.No.1.1. How will you decide whether or not the district was in the grip of an outbreak?

Table-1.1 describes the reported data on GE from the Koraput district during 1988-1991.

Table 1.1
Cases and Deaths due to GE in district Koraput, 1988-91

Year	No. of cases	No. of deaths
1988	981	225
1989	375	112
1990	1387	173
1991 (upto August)	2380	426

Q.No.1.2. Now, will you consider it an outbreak of GE? If yes, why? If not, why?

Analysis of the age distribution of 308 deaths revealed that about 9% of deaths occurred in children below five years of age and about 62% of deaths occurred in adults above 20 years of age.

Q.No.1.3. Does it help you in suspecting cholera as the cause of this outbreak?

Q.No.1.4. What was the most disturbing features in this outbreak? Was it preventable?

Rectal swabs from 59 cases were examined in the laboratories of NICD, Delhi. 15 samples were positive for *V.cholerae* O1 biotype El Tor. The isolates were sensitive to tetracycline, nalidixic acid, ampilcillin and chloramphenicol, but resistant to furazolidone and streptomycin. The other samples were found negative for any enteropathogens.

Q.No.1.5. What are the possible reasons for 44 of 59 samples being found negative for enteropathogens?

Q.No.1.6. Assume yourself as the team leader for the investigation of this outbreak. (i) How will you plan the investigations? (ii) How will you control the outbreak?

Exercise 2

During the period from 18 May to 19 June, 1991, 392 cases of clinically suspected typhoid fever were treated at the outpatient department of PHC Galore, district Hamirpur, Himachal Pradesh. Of them, 101 were admitted in the PHC. Analysis of the data on clinical features in the admitted patients revealed that they initially presented with fever (100%), headache (74%), pain abdomen (18%), vomiting (17%), diarrhoea (15%), constipation (7%), palpable spleen (57%) and palpable liver (13%). *Salmonella typhi* was isolated in 10 of 25 blood samples examined in the laboratories of Medical College, Shimla.

Q.No.2.1. What makes this an outbreak of typhoid fever? Comparable data from previous years are not available?

Q.No.2.2. If you want to organize a survey (using paramedical health worker/medical officers) for active search of cases, what case definition will you use?

A line list of admitted cases was available in the primary health centre, Galore. It provided information on name, age, sex, address and date of onset of symptoms for all the 101 cases.

Q.No.2.3. How will you analyze the data? Prepare dummy graphs and tables.

Table 2.1 provides you data on admitted cases by date of onset of symptoms.

Table 2.1
Weekly distribution of admitted cases by week of onset of symptoms

Week ending	No. of Cases
12.05.1991	0
18.05.1991	4
25.05.1991	16
01.06.1991	41
08.06.1991	25
15.06.1991	12
upto 19.06.1991	3
Total	101

Q.No.2.4. Prepare epidemic curve using data given in Table 2.1

Q.No.2.5. What type of epidemic curve have you got? How do you interpret this epidemic curve?

Tables 2.2 and 2.3 describe the cases by age, sex and village.

Table 2.2
Cases of typhoid fever by age and sex, PHC Galore

Age (years)	Male	Female	Total
0-1	0	0	0
2-5	2	8	10
6-15	25	10	35
16-25	18	17	35
26-35	2	5	7
36-50	5	4	9
50 +	0	5	5
All ages	52	49	101

Table 2.3
Cases of typhoid fever by sex and village, PHC Galore

Village	Male	Female	Total
Lanjiana	22	31	53
Daswin	17	1	18
Pahal	1	2	3
Halti	2	3	5
Ghirmani	4	0	4
5 other villages	6	12	18
Total	52	49	101

Q.No.2.6 Using the data available in tables 2.2 and 2.3, can you suggest a hypothesis for transmission of infection?

A marriage function was held in village Lanjiana on 16th May, 1991. The bridegroom belonged to village Daswin. Only males accompanied the marriage party, whereas persons of both sexes participated from bride's side. During this function, water was used from a *Bawri* (a local water body). Analysis of water from Bawri revealed very high contamination; coliform count 1600/100 ml, faecal coli 275/100 ml of water. Those who attended the function started becoming ill after about 2 weeks. Contaminated water from Bawri was suspected as the cause of this outbreak.

Q.No.2.7 Can you provide some alternative explanation for the transmission of infection during the marriage function?

Exercise 3

Almost all the outbreaks of viral hepatitis in India are due to faeco-orally transmitted hepatitis E. These outbreaks have been invariably linked to contaminated water supply. An occasional outbreak may be due to hepatitis A. Recently, a few outbreaks of hepatitis B epidemiologically linked to unsafe injections have also been reported. This exercise pertains to an outbreak of hepatitis E.

Residents of a locality in North West Delhi (SD Block, Pitampura : population 1435) felt an unusual increase in the cases of jaundice in April, 1994. The block was inhabited by people belonging to middle or upper socio-economic strata. All the residents had access to and used only sanitary latrine. The Block had piped water supply. There was no other source of water. The water supply was intermittent and did not fulfill the requirements of people. The residents therefore, used on-line-booster pumps to lift the water to their overhead tanks.

Q.No.3.1. How will you plan your investigation to (i) diagnose the disease and (ii) select a suitable case definition (for health worker) to assess the extent of outbreak?

Q.No.3.2. A house to house survey revealed 27 cases of jaundice in 1435 population within a reference period of 3 months. The attack rate of jaundice was found to be 1.9 percent. Many outbreaks are on record where a varying number of cases of jaundice (a few cases to many thousands) occurred in a short period. 27 cases in SD Block were also considered an outbreak. On what ground you could have reached to this conclusion?

Q.No.3.3. You found that most of the cases were due to hepatitis E (laboratory findings). You suspect contaminated piped water as the major factor in this outbreak. How will you substantiate your suspicion?

Q.No.3.4. If you are dealing with an unusual clustering of hepatitis B cases, how would you have plan to find out the mode of transmission?

Q.No.3.5. The outbreak in SD Block was due to hepatitis E. Using the data already provided to you, can you speculate (i) why did the outbreak occur at all? (ii) why was the outbreak not explosive?

Exercise 4

A patient from village Banyani (population 3403) came to the OPD of PHC on 7.10.1991 with complaints of fever, headache, bodyaches and chills. He also informed the medical officer about a large number of cases having similar illness in the village, of whom many had died.

Q.No.4.1. If you happened to be the incharge of PHC, what steps will you take and why?

A team of doctors from the PHC surveyed the village on 8.10.1991. They examined 756 persons. 696 (92%) of them were presently suffering from fever usually accompanied with rigors and chills. None of them had signs of meningitis. A medical specialist examined 63 patients of fever. 25 of them (40%) had spleen enlargement.

Q.No.4.2. Will you consider this episode as an outbreak of febrile illness? Do you need more information to reach at some conclusion?

Q.No.4.3. What was the most probable cause of this outbreak?

During the survey undertaken on 8.10.1991, 466 blood slides were collected from fever cases. 81 slides were found positive for malarial parasite (*Plasmodium vivax* 66, *Plasmodium falciparum* 15). The PHC considered it an outbreak of falciparum malaria. District authorities were informed about the outbreak and a treatment centre was established at village Banyani to treat the patients.

The state health authorities informed the National Institute . of Communicable Diseases on 1.11.91 about the outbreak. The message stated that a large number of fever cases and 21 deaths had occurred in a village in district Farukhabad.

Q.No.4.4. You do not have access to any other information except this message. Will you include JE and/or dengue fever in differential diagnosis? If yes, Why? If not, why?

NICD team visited the affected area during 1-3 November 1991. The team collected the following data from the PHC.

(i) 2294 blood slides were collected in village Banyani upto 2.11.91. 325 were found positive for malarial parasite (*P.falciparum* 131, *P.vivax* 194). About 40% of the positive slides were due to *P.falciparum.*

(ii) During the same period, 2184 slides were collected from other villages of PHC within 5 kilometer of village Banyani. 208 were found positive for malarial parasite (*P.falciparum* 36, *P.vivax* 172).

(iii) Malaria situation in PHC in the last five years is shown in Table 4.1.

Table 4.1
Malaria situation in PHC Talgram, 1987-1991

Year	Slides collected	Slides positive for MP		
		P.vivax	*P.falciparum*	Total
1987	3170	9	0	9
1988	5921	7	0	7
1989	5822	4	0	4
1990	7384	2	0	2
1991 (upto September)	7233*	2	0	2

* 948 slides still to be examined.
Note:- Population of the PHC about 2 lakhs.

(iv) 19 persons died due to suspected malaria; 3 in August, 12 in September and 4 in October.

Q.No.4.5 Why was this outbreak not detected in the early rising phase?

While going through the streets in village Banyani, it was observed that a large number of residents were rolling *bidies* (local cigarette) in front of their houses. On inquiry, it was found that *bidi* rolling and agriculture were the main occupations in village Banyani and a few surrounding villages. It provided the clue to the genesis of the outbreak in the village Banyani.

Q.No.4.6. Can you speculate on the genesis of outbreak of falciparum malaria in village Banyani? It is noteworthy that District Farukhabad did not report any case of falciparum malaria in the last 3 years.

Q.No.4.7. You have been given the responsibility to investigate and control this outbreak. How will you plan further investigations?

(Note:- See a related exercise in Module on Disease Surveillance)

CHECK LIST FOR MODEL DISTRICT LEVEL LABORATORY FOR DISEASE SURVEILLANCE

1. The laboratory should be able to perform following:

Microscopy: Rapid presumptive diagnosis of	Cholera Tuberculosis Diphtheria Plague Malaria Filariasis Meningitis
Bacteriological culture of	Stool, especially for cholera
Bacteriological examination of	Water for coliform count
Rapid diagnostics for	AIDS Meningitis due to *meningococci, pneumococci* or *H.influenzae* HBsAg (also for volunteer donors) Syphilis
Non-ELISA based tests	Typhoid fever

2. Laboratory should be equipped to collect, store and transport specimens for following:

Stool, blood/serum, CSF
milk/food
Vomitus
For various diseases including arboviral diseases such as JE and dengue fever, poliomyelitis, and measles
Samples from environment such as soil

3. Laboratory should have the facilities to wash and sterilize glassware etc. needed for collection and transportation of clinical and environmental specimens as well as for separating serum from blood samples.

4. Laboratory should have adequate inventory/or access to basic material that may be needed for surveillance and investigation of outbreak or to provide support in times of disasters.

5. Standard operating procedural manual should be available with the laboratory.

6. Adequate staff members who are qualified and/or oriented/trained for undertaking disease surveillance work.

7. Sufficient stationery for maintaining the records and dispatching the same to other centers.

8. Laboratory should have access to electronic communication network for rapid transmission of results and/or early warning signals.

CHECK LIST
FOR DISTRICT LABORATORY FOR DISEASE SURVEILLANCE

S.No.	Activity	Yes/No
1.	**Does the lab undertake microscopic examination for**	
	Stool sample for cholera bacilli	
	Sputum for tuberculosis bacilli	
	Throat aspirate swab for diphtheria bacilli	
	Bubo aspirate/sputum for plague bacilli	
	Peripheral blood smear for malarial parasite	
	Peripheral blood smear for microfilariae	
	CSF for meningitis organisms	
2.	**Does the lab undertake bacteriological examination of**	
	Faeces for cholera bacilli	
	Water samples for coliform count	
3.	**Does the lab have rapid diagnostic kits for**	
	HIV infection	
	Meningitis	
	Syphilis	
	Australia antigen (HBsAg)	
4.	**Are following equipment available in functional condition in lab**	
	Autoclave	
	Microscope	
	Centrifuge	
	Refrigerator	
	Deep freezer (-20c)	
	Balance	
	pH meter	
	Gas meter	
	Incubator	
	Water bath	
	Hot air oven	
5.	**Does lab perform serological tests**	
	VDRL	
	Widal	
	ASO	
	Any other	
6.	**Does lab has full time professionals**	
	Microbiologist/Medical Officer trained in microbiology	
	Technical staff with qualification in lab medicine	
	1.	
	2.	
	3.	
	Supportive staff with experience in lab	
	1.	
	2.	
	3.	

7.	Does the lab has at any point of time followings	
	1. 100 sterile glass syringes with needles	
	2. 100 screw capped glass vials for blood collection	
	3. 100 screw capped plastic vials for storage of serum	
	4. 100 plastic/glass petri dishes	
	5. Cary Blair transport medium (50 vials)	
	6. 10 pairs of Gloves	
	7.	
8.	Are SOPMs available with the lab	
9.	Does the lab has an access to NICNET/ERNET	
10.	Does the lab has a system of record storing which is:	
	Manual	
	Computerized	
11.	Is there any periodic evaluation of working of lab	
12.	Is there a stand-by supply of electricity	
	If yes, what are the equipment which are on it:	
13.	Does the lab has an inventory of regional and national reference labs where samples can be sent:	
14.	Does the lab participate in any external quality assurance scheme in bacteriology/serology?	

INTER-DEPARTMENTAL COMMITTEE
SUGGESTED AREAS OF RESPONSIBILITY AND ACTION

District administration/Zila Panchayat

- mobilize resources by organizing meetings with
  - concerned government departments
  - non-governmental agencies
  - community leaders
- ensure adequate quality monitoring of water samples
- repair of leakage in water pipe lines
- arrange safe water supply
- ensure supplies of ORS packets and other essential items
- ensure vector control measures
- ensure adequate facilities for transportation of serious patients to district hospital, if necessary
- strengthening of existing provision under the Drug & Cosmatic Act to curtail over the counter sale of parenteral drugs
- provide relevant information to the press
- monitor status of control activities

District Health Office / Municipal Health Office

- arrange repair of leakage in water pipe lines
- alert health personnel to report cases and to monitor trends
- arrange active surveillance in affected area
- ensure that treatment guidelines are followed in hospitals and other health facilities
- ensure availability of ORS packets and other essential items
- strengthening of existing provision under the Drug & Cosmatic Act to curtail over the counter sale of parenteral drugs
- ensure vector control measures
- arrange health educational camps and distribution of health educational material
- arrange chlorination of water sources if possible
- arrange water quality monitoring
- convene meeting under district administrator to seek cooperation of other government departments and NGOs
- check sterilization practices of medical practitioners for syringes, needles and sharp instruments

Concerned Department (s) responsible for water supply

- repair of leakage in water pipe lines
- arrange potable water supply, including water tankers if necessary
- arrange chlorination of water
- ensure water quality monitoring

Other government departments such as social welfare, education, tribal welfare and NGOs

- dissemination of relevant information
- promotion of oral rehydration therapy
- ensure vector control measures
- check sterilization practices of medical practitioners
- reporting of cases

Panchayat members, village pradhans, community leaders

- dissemination of relevant information
- promotion of oral rehydration therapy
- ensure vector control measures
- check sterilization practices of medical practitioners
- reporting of cases
- monitoring chlorination of water sources such as wells
- arranging transportation of serious cases to hospital

SUGGESTED FORMAT FOR LINE LIST OF CASES

Sl. No.	Name of Patient	Father's/ Husband's Name	Address	Age	Sex	Date of Onset of symptoms	Symptoms	Outcome of illness (still ill/ died / recovered)	Remarks

Note:- A column on immunization status should be added for vaccine preventable diseases.

FORMAT FOR OUTBREAK INVESTIGATION REPORT

General Information

State : _____

District : _____

Town/PHC : _____

Ward/Village : _____

Population : _____

Background Information

Person reporting the outbreak : _____

Date of report : _____

Date investigations started : _____

Person(s) investigating the outbreak _____

Details of Investigation

Describe how the cases were found (may include: (a) house-to-house searches in the affected area; (b) visiting blocks adjacent to the affected households; (c) conducting record reviews at local hospitals; (d) requesting health workers to report similar cases in their areas, etc.):

_____

_____

_____

_____

Descriptive Epidemiology

11. Cases by time, place and person (attach summary tables and relevant graphs and maps).
12. Age-specific attack rates and mortality rates
13. High-risk age-groups and geographical areas.

Description of Control Measures taken

_____

Description of Measures for Follow-up Visits:

_____

_____

_____

Brief Description of Problems encountered

_____

_____

_____

Factors which, in your opinion, contributed to the Outbreak

_____

_____

_____

Conclusions and Recommendations

_____

_____

_____

Date (Name and Designation)

Note: This report should be submitted by the investigating officer (State/District/PHC Nodal Officer) to the next higher authority within a week of completion of investigation. Tables and Graphs should be included wherever appropriate.

Teaching module No. 3

INVESTIGATION & CONTROL OF OUTBREAKS

CHOLERA

National Disease Surveillance Programme
Directorate of Health & F. W. Services
Bangalore-560 009, Govt. of Karnataka

INVESTIGATION & CONTROL OF OUTBREAKS

CHOLERA

NATIONAL INSTITUTE OF COMMUNICABLE DISEASES
(DIRECTORATE GENERAL OF HEALTH SERVICES)
22-SHAM NATH MARG, DELHI - 110 054

1998

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.. Notification of cholera cases

.1. Cholera is endemic in India and several outbreaks of the disease ave been reported. Because cholera has the potential of rapid spread eading to an acute public health problem, special attention is equired to be given to the surveillance and prompt follow up action n reported cases of cholera.

.2. A suspect case of cholera must be notified immediately by nessenger, telephone or fax to the local health office. Weekly otification of confirmed cholera cases is required to be made by the tate health authorities to the Directorate General of Health Services Director, Central Bureau of Health Intelligence, Pushp Bhavan, Madangir Road, New Delhi - 110062) and endorsed to Director, ational Institute of Communicable Diseases, 22 Shamnath Marg, elhi -110054, (Phone:- 2521272, 2521060, 2913148; FAX: 2922677; elegram: COMDIS, DELHI). The age, sex and address of the patient hould be included.

.3 If appropriate measures are taken, cholera remains restricted to limited habitation. Therefore, reporting of taluka and district help in entifying the affected area.

.4. The first suspect case of cholera in the area must be notified nmediately to the local health officer. Laboratory confirmation ould be obtained at the earliest opportunity and the results timated to local health office as soon as these become available.

Clinical manifestation and case definition

1. In a majority of the cases, the infection is mild with no overt mptoms or only mild diarrhoea. However, in a few cases the onset rapid with severe watery diarrhoea and vomiting, resulting in loss of rge amounts of fluids and electrolytes.

CASE DEFINITION

esumptive

- Severe dehydration or death from acute watery diarrhoea in a patient 5 years of age or older in non-endemic areas
- Acute watery diarrhoea in a patient 5 years of age or older in an area where an epidemic is occurring

nfirmed

- *Vibrio cholerae* O1 or O139 is isolated from the stool samples of any patient with diarrhoea

DLS-310
05180

2.2. The clinical features of moderate to severe cases of cholera are the following:

- acute onset
- severe watery diarrhoea
- vomiting
- signs of dehydration and electrolyte imbalance

DEHYDRATION	SEVERE DEHYDRATION
• increased thirst • restlessness irritability • decreased skin turgor • dry mouth	• lethargic • floppy (hypotonia) • unable to drink • decreased urine • fall in BP • tachycardia • unconscious

HYPOKALEMIA
• hypotonia • cardiac arrhythmia • paralytic ileus • cardio-respiratory failure

Note:

Any two or more signs of dehydration in a patient with history of acute watery diarrhoea and vomiting

Any one or more signs of severe dehydration or hypokalaemia in a patient with history of acute watery diarrhoea and vomiting

2.3. The symptoms of mild cases of cholera are clinically indistinguishable from non-specific acute diarrhoea. In more than 90% of the cases, cholera is mild.

2.4 It would also be useful to know if:

- there are any other laboratory confirmed cases in area

OR

- there is a clustering of cases clinically compatible with cholera

Any one of the two above will support the presumptive diagnosis of cholera. It would also facilitate better understanding of the epidemiology of disease and institution of appropriate control measures.

3.1. There are more than 60 serogroups of *Vibrio cholerae*, but only serogroup O1 and 0139 cause cholera.

3.2. *V.cholerae* O1 occurs as two biotypes - classical and El Tor. Each biotype also occurs as two serotypes - Ogawa and Inaba.

3.3. Almost all the recent cholera outbreaks have been caused by the El Tor biotype. Cases caused by the classical biotype have not been reported in India since 1980. The El Tor biotype also causes a higher proportion of asymptomatic infections than the classical biotype and survives longer in the environment.

3.4. In late 1992, large scale epidemics occurred in India and Bangladesh caused by a new serogroup - *V.cholerae* O139.

4. Reservoir

4.1. Man is the only host. Patients remain infectious usually for a few days after recovery from clinical symptoms. Occasionally the carrier stage may persist for several months. Antibiotics, to which the strain is susceptible, shorten the period of communicability.

4.2. *V.cholerae* can survive for long periods in the environment and can live in association with certain aquatic plants and animals, making water an important reservoir for infection.

5. Mode of transmission

5.1. Infection usually spreads through contaminated water and food.

5.2. The dose of *V.cholerae* required to produce illness depends on the susceptibility of the individual. It can be affected by the level of acidity in the stomach (the vibrio is destroyed at pH 4.5 or lower) and by immunity produced by prior infection. In endemic areas, breast-feeding protects infants and young children.

COMMON SOURCES OF INFECTION	
Drinking water • contaminated at its source • contaminated during storage • ice made from contaminated water	Food • contaminated during or after preparation • fruits and vegetables, 'freshened' with contaminated water and eaten raw • fruits and vegetables, grown at or near ground level and fertilised with night soil or irrigated with water contaminated with human waste, and eaten raw

6. Incubation period

6.1. Incubation period varies from a few hours to 5 days, usually 2-3 days.

7. Clinical management

7.1. Early treatment, in most cases by oral rehydration therapy, can reduce the case fatality of cholera to less than 1%. If treatment is delayed or inadequate, death from dehydration and circulatory collapse may follow rapidly.

7.2. The clinical condition of the patient should be monitored during and after rehydration until diarrhoea stops. Rapid loss of fluids and salts can result in dehydration, acidosis and potassium depletion if symptoms of diarrhoea and vomiting persist. Rehydration therapy should continue to replace ongoing loss of fluids and salts. Young and malnourished children need special attention.

ORAL REHYDRATION THERAPY

- Recommended ORS solution
  - * WHO formula (see annex 5)
- Unsuitable ORS
  - * ORS with high glucose content
  - * ORS with saccharine and colouring agents

7.3. Nearly 80 to 90% of the patients can usually be adequately treated with oral rehydration salt (ORS) solution alone, without intravenous therapy and antibiotics.

ORAL REHYDRATION THERAPY

- give 100 ml/kg body weight of ORS solution in the first 3-6 hours to correct dehydration
- if the patient is thirsty and wants to drink more, allow to drink
- after rehydration has been achieved, continue giving ORS solution for replacement of ongoing losses. Plain water and home available fluids can be taken

7.4. In severely dehydrated patients ORS solution should be started as soon as the patients are able to drink, even before the initial intravenous therapy has been completed. Patients can also be permitted to drink plain water. For preparation of ORS at home, see annex 6.

Quantity	*Infants*	*Older children/ Adults*
30 ml / kg body wt	First 1 hour	First 30 min
70 ml / kg body wt	Next 5 hours	Next 2½ hours
100 ml / kg body wt	6 hours	3 hours
• reassess clinical condition every 1-2 hours; if hydration is not improving give IV infusion more rapidly	• assess for signs of overload as patient recovers - evidence of swelling, shortness of breath or puffiness	• if patient can drink, start ORS solution along with IV infusion. When signs of severe dehydration disappear, continue with ORS

7.5. Intravenous therapy may be required for those with clinically severe form of cholera. IV fluids should be used only for the initial rehydration of patients with *severe dehydration*, including those who are in shock. Ringer's lactate solution is the preferred fluid for intravenous rehydration. Normal saline solution is less effective for intravenous rehydration, but can be used if Ringer's lactate solution is unavailable. ***Plain glucose solutions are ineffective and should not be used.***

IV FLUID THERAPY

- Preferred
  - * Ringer's lactate solution
- Suitable
  - * Normal saline
    (*does not correct base acidosis and potassium losses*)
- Unsuitable
  - * Plain glucose (dextrose) solution
    (*is not effective for rehydration, correction of base acidosis or replacement of potassium losses*)

7.6. Patients on intravenous fluid therapy should be monitored at regular intervals to check for signs of improvement in the clinical condition of the patient. Care must be taken to ensure that the patient is not overloaded.

7.7. In severe cases, antibiotics can reduce the volume and duration of diarrhoea and can shorten the period during which the cholera vibrios are excreted. Antibiotics can be given orally as soon as vomiting stops, usually within 3-4 hours of starting rehydration.

There is no advantage in giving injectable antibiotics which are expensive.

COMPLICATIONS OF IV FLUID THERAPY

Pulmonary oedema is caused when too much IV fluid is given, and especially when metabolic acidosis has not been corrected. The latter is most likely to occur when normal saline is used for IV rehydration and ORS solution is not given at the same time. When the guidelines for IV rehydration are followed, pulmonary oedema should not occur. ORS solution never causes pulmonary oedema.

Renal failure may occur when too little IV fluid is given, when shock is not rapidly corrected, or when shock is allowed to recur, especially in persons above the age of 60. Renal failure is rare when severe dehydration is rapidly corrected and normal hydration is maintained according to the guidelines.

- Guidelines for Cholera Control, WHO 1993

7.8. ***Use of antibiotics for mild cases is not recommended.*** This will hasten the development of antibiotic resistant strains as well as exhaust supplies which may be needed for severe cases. Patients who benefit most from antibiotic treatment are those with severe dehydration.

7.9. The choice of antibiotics should take into account local patterns of resistance to antibiotics. Knowledge of antibiotic sensitivity patterns in the immediate or adjacent areas is important. Studies conducted at NICD, Delhi; National Institute of Cholera and other Enteric Diseases (NICED), Calcutta and King Institute of Preventive Medicine, Chennai have shown that *Vibrio cholerae* that are currently prevalent are resistant to furazolidone, cotrimoxazole, ampicillin, nalidixic acid and streptomycin. These continue to be sensitive to tetracycline and norfloxacin.

No anti diarrhoeal, anti-emetic, antispasmodic, cardiotonic or corticosteroid drugs should be used to treat cholera. Blood transfusion and volume expanders are not necessary.

- Guidelines for Cholera Control, WHO 1993

7.10. Patients should be encouraged to take food, after severe vomiting has stopped, usually within 3 to 4 hours after starting rehydration. Breast-feeding of infants and young children should be continued.

8. Health education

8.1. Health education and public awareness and co-operation are important to control an outbreak. If the community knows how the outbreak spreads and what measures they can take in their own families, the risks can be considerably reduced. It is also important that the public should know that treatment is simple and effective and there should be no cause for panic. ORS packets should be widely accessible. While the key messages will essentially remain the same for all areas, the language and style may be adapted to local needs.

The Guidelines for Cholera Control, WHO 1993 have suggested several messages....Some of these are given below:

KEY POINTS FOR PUBLIC EDUCATION

To prevent cholera

- drink water from a safe source or water that has been disinfected (boiled or chlorinated)
- cook food or reheat it thoroughly and eat it while it is still hot
- avoid uncooked food unless it is peeled or shelled
- wash hands before preparing or eating food
- wash hands after using toilet or any contact with excreta
- dispose off human excreta promptly and safely

Remember

- with proper treatment, cholera is not fatal
- take patients immediately to a health facility
- give increased fluids. If ORS packets are available, give ORS solution as soon as diarrhoea starts
- cholera vaccination is *not* recommended

THREE SIMPLE RULES FOR CHOLERA PREVENTION

- Cook your food
- Drink safe water (chlorinated or boiled)
- Wash your hands

IS YOUR WATER STORED PROPERLY?

- Clean water can become contaminated again if it is not stored safely
- Water should be stored in a clean container with a small opening and a cover. It should be used within 24 hours
- Pour the water from the container or use a tap or ladle to draw water from the container. Do not dip a cup or glass in a container to draw water

8.2. It is particularly important to inform the public that most cases of cholera can be treated with simple measures and that vaccination is not effective.

9. Laboratory support

9.1. Treatment of cholera does not depend on the results of laboratory examination. However, laboratory examination of specimens from the first few suspected cases is important to confirm diagnosis and to determine the characteristics of the organism.

9.2. A sufficient number of stool specimens should be examined to identify the causative organism and test its sensitivity to antibiotics. Once the presence of cholera is confirmed, ***it is not necessary to examine specimens from all cases or contacts***. In fact, this should be discouraged since it places an unnecessary burden on laboratory facilities and is not required for effective treatment.

9.3. Stool specimens or rectal swabs should be sent to the laboratory in a transport medium (e.g. Cary-Blair medium, VR medium, Alkaline Peptone Water). If a transport medium is not available, cotton tipped rectal swab soaked in the liquid stool should be placed in a sterile plastic bag and tightly sealed. Specimens should be collected before the patient has received any antibiotics.

9.4. Full particulars of the patient(s) from whom samples have been collected must be sent along with the samples as many factors can influence the results of the laboratory tests. The information that should accompany each stool sample is given below:

- name
- name of mother or father
- sex
- date of onset of symptoms
- provisional diagnosis
- clinical outcome (recovered, under treatment, dead, not known)
- antibiotic received prior to collection of sample - Y/N/not known
- date sample collected
- full address

9.5. Apart from prior treatment with antimicrobials, the conditions of collection and transportation of samples can influence laboratory tests. The recommended practices and precautions to be taken to minimise deterioration in the quality of the sample are given in the box.

9.6. Keep an inventory of all laboratories in the district which can undertake culture and identification of *V.cholerae* 01. The names of these laboratories should be known to the medical officers of the peripheral health facilities. Each laboratory must be well stocked with the media and other reagents. The available stocks should be verified well before the expected seasonal increase of cases of diarrhoeal diseases.

9.7. In districts considered at high risk where outbreaks have been reported in the past, orientation session of the paramedical personnel, laboratory technicians and medical officers is recommended for updating their knowledge and skills in the correct procedures for collection, storage and transportation of laboratory samples.

9.8. The states could also identify a reference laboratory to perform antibiotic sensitivity tests.

COLLECTION AND TRANSPORTATION OF STOOL SAMPLES

- collect the stool sample before the patient receives an antibiotic
- use a clean cotton tipped swab and introduce well into the rectum. When this is done well, the swab will become moist and may be faecally stained.
- alternatively, collect freshly passed liquid stool in a bottle or a cotton tipped swab.
- send the sample to the laboratory in a tightly sealed screw capped sterile bottle *if the sample can reach the laboratory within two hours.*
- send the sample to the laboratory in a tightly sealed screw capped sterile bottle with Cary-Blair transport medium (or VR medium or Alkaline Peptone Water) *if it will take more than two hours to reach the laboratory.*
- if transport medium is not available, soak strips of blotting paper with liquid stool. Send these to the laboratory in carefully sealed plastic bags to prevent drying.
- send the samples using a cold chain. If this is not possible send at ambient temperatures.
- bottles or plastic bags should be placed in separate plastic bags each to prevent leakage of the potentially contaminated material.
- each sample should be labelled. Detailed information as indicated at 9.4 should be sent for each sample.

9.9. More complicated procedures such as phage typing and toxin testing are undertaken by the national reference laboratory at the

National Institute of Cholera and other Enteric Diseases (NICED), P-33, CIT Road, Scheme XM, Beliaghata, Calcutta - 700 010, Phone:-3504598, 3505533, 3504478, 3500448 FAX:-3505066.

10. Prevention and control of an outbreak

10.1. The risk of an outbreak of cholera and its spread can be minimised by taking measures given below. There are no other alternatives for the control of an outbreak of cholera.

- provision of safe water
- adopting safe practices in food handling
- sanitary disposal of human waste
- personal and domestic hygienic practices

10.2. The above steps are required both as long-term measures to prevent cholera as well as measures to be taken in a focal area where an outbreak is anticipated. Community participation is essential to preempt an outbreak so that safe practices are followed for storing water and for food handling.

10.3. When an outbreak occurs or when the risk of such outbreaks is high, the co-operation of other government departments, non-governmental agencies and the community often becomes necessary. Such help will be more forthcoming if mechanisms for interaction have been developed before the onset of an outbreak. It might be useful to convene a meeting of the concerned departments, community representatives and the NGOs before the expected seasonal increase of cases of diarrhoeal diseases. Some mechanism for briefing the press should also be established. Some suggested areas in which the government departments and NGOs can assist may be seen at Annex 7.

10.4. According to WHO guidelines, chemoprophylaxis, vaccination and travel & trade restrictions have been found to be ineffective and are not recommended for the control of an outbreak of cholera or for the prevention of its spread to other areas.

INEFFECTIVE MEASURES

- chemoprophylaxis
- vaccination
- travel and trade restrictions (*cordon sanitaire*)

10.5. Mass chemoprophylaxis is not only ineffective in preventing the spread of cholera, but it also diverts manpower and resources from effective measures. In several countries, it has contributed to the

nergence of antibiotic resistance in the vibrio, depriving severely ill tients from valuable treatment. The value of selective chemotherapy household contacts is also doubtful. It is not recommended as a utine measure.

.6. Vaccines that are currently available do not have high vaccine ficacy rates. 2 doses are required for primary immunization. In those no are immunised, protection lasts for 3-6 months only. Vaccination es not reduce the incidence of asymptomatic infections or prevent e spread of infection. Vaccination campaigns divert resources and anpower from more useful control activities. Inadequately sterilised edles and syringes may transmit the parenterally transmitted fections such as HIV and Hepatitis B. ***No country requires avellers to have a cholera vaccination certificate.***

RISK OF CHOLERA TRANSMISSION THROUGH FOOD TRADE

Although there is a theoretical risk of cholera transmission associated with international food trade, the weight of evidence suggests that this risk is small and can normally be dealt with by means other than embargo on importation.

A large number of tests carried out on commercially imported foods from affected countries (most recently from South America) have not detected *Vibrio cholerae* 01. Indeed, although individual cases and clusters of cases have been reported, WHO has not documented a significant outbreak of cholera resulting from commercially imported food.

- Guidelines for Cholera Control, WHO 1993 page 29

.7. Travel and trade restrictions between countries or different eas within a country do not prevent the spread of cholera. Majority the infected individuals have no symptoms. Setting up check-posts quires massive inputs and diverts attention from other more useful ntrol measures.

1. Preparatory action in anticipation of an outbreak

1.1. Alert health personnel and hospitals to report increase or ustering of cases of diarrhoea. If a case of dehydration following arrhoea is seen in children 5 years or older, cholera should be uspected and notified to the local health office immediately. All ealth facilities including those having only OPD should maintain cords of patients seen. Address of the patients should be recorded nd maintained locally for use in case an outbreak occurs. If there is a udden increase in cases or clustering of cases in an area, field

investigations should be carried out and necessary corrective action taken. An effective surveillance system can provide an early warning signal and help in initiating appropriate actions to ,quickly contain outbreaks of all waterborne diseases, including cholera.

Particular attention may be given in the pre-monsoon period before the expected seasonal increase of water-borne diseases; however, these measures are expected to be in place round the year.

11.2. Ensure that the health personnel are adequately trained in oral rehydration therapy and that the recommended guidelines are followed in the hospitals. If neccssary, orientation sessions or retraining may be organised. Early treatment can save many lives.

11.3. Arrange random checks for water quality for coliform organisms (faecal contamination). Special attention may be given to high risk pockets. In places where water is found to be of unsatisfactory quality, follow-up action may be taken with the concerned authorities for water supply. If feasible, chlorination should be carried out to render water safe for drinking (Annex 3).

11.4. Health educational activities should be carried out in the community to promote safe practices especially before the monsoons when the seasonal increase of cases of diarrhoeal diseases can be expected.

11.5. Check that adequate stocks of essential supplies are available and have been distributed to the peripheral health institutions well in advance of the expected seasonal increase of cases of diarrhoeal diseases. ORS packets should be available in all the health facilities. It is recommended that adequate stocks of bleaching powder, chlorine tablets, IV fluids and appropriate antibiotics are in stock in case of an emergency.

11.6. **A nodal officer should be identified at the state and district levels** with the responsibility of collecting and analysing relevant surveillance reports and for ensuring that appropriate follow-up action as required is taken up promptly. The name of the nodal officer should be made widely known so that she/he could be contacted in case of an emergency or if clarifications or additional information is required by the medical and health personnel in the periphery.

12. Investigation of an outbreak

12.1. Recognition of early warning signals, timely investigations and the application of specific control measures can limit the spread of an outbreak and prevent deaths. Control measures are most effective when selective interventions are applied early.

12.2. When an increase in the number of cases of diarrhoeal diseases is reported, the areas from where the cases are reported should be checked. Diagnosis should be confirmed of as many cases as possible to check that it is clinically compatible with cholera.

12.3. Stool samples from a few typical cases may be collected and sent for laboratory examination (see 9)

12.4. Line listing of cases, including age, sex and address should be made. Active search should be made for more cases.

12.5. Identify sources of drinking water. Check water quality for bacteriological contamination. If piped water supply, check for possible leakage. If a common source of water supply has been identified, inform public not to use the water for drinking purposes or for washing utensils etc.

12.6. Arrange alternate source for water, including tankers if possible. If possible chlorinate water source. Distribute tablets for domestic chlorination of water along with instructions for its proper use, if necessary (Annexe 4). Contact concerned authorities for water supply.

12.7. Alert health facilities and hospitals in the area. Make sure that adequate supplies of ORS, IV fluids, appropriate antibiotics and other essential supplies are available.

PRECAUTIONS AT TREATMENT CENTRES

- quarantine not necessary, although restricted contact between patients and community may be encouraged
- strict infection control measures such as face mask, gloves or special clothing for hospital staff and visiting family members is not required
- frequent hand-washing is recommended
- safe disposal of excreta and vomitus is necessary

12.8. Arrange health educational activities in the community regarding personal and domestic hygiene, recommended sources of safe water supply, oral rehydration therapy and health facilities where patients can be taken for treatment (see 8).

12.9. Active case reporting should be continued for at least one week (preferably two weeks) after the last case.

OTHER PRECAUTIONS AT HOME AND IN THE COMMUNITY

- bedding, clothing, mattresses can be disinfected by thorough drying in the sun
- the simplest method for a family or a small rural health centre to dispose of cholera stools is by putting them in a pit latrine or burying them.
- In large hospitals, liquid stools and vomitus can be disinfected before disposing these in the toilet by 4% hypochlorite. Semi-solid and other waste can be incinerated.

12.10. On confirmation of a focal outbreak of cholera, take precautionary measures as indicated in para 11 in other potentially high risk pockets in the district.

12.11. Notify immediately to the concerned state officer as soon as a clinically compatible case of cholera is reported.

12.12. The detailed procedures for conducting outbreak investigation, data analysis and report writing are given in a separate document (Outbreak Investigations - A Field Guide). A suggested format for report writing may be seen at Annex 8.

Annex 1

SAFE WATER

- boiling for 1 minute will kill or inactivate *V.cholerae* and other common organisms that cause diarrhoea. Boiling is, however, expensive and not practical especially in areas where outbreaks of cholera and other diarrhoeal diseases are most likely to occur because of fuel shortages

- when surface water/ handpump water is contaminated, this source should be closed for drinking water purposes. This information should be prominently displayed indicating that the source of water is not fit for use. In Delhi, shallow handpumps are painted red. Alternate water source should be provided, including water tankers during the course of an outbreak

- where it is feasible chlorination of the water source, such as a draw-well should be immediately organised

- in urban areas, immediate co-ordination with the agency responsible for water supply should be organised to ensure chlorination of water source and repair of water pipes, if indicated

- chlorine releasing tablets may be used for domestic purposes in the area of an outbreak

- community should be encouraged to use narrow mouthed containers for water storage to reduce secondary transmission in the family

Annex 2

RECOMMENDED MINIMUM CHLORINE LEVELS IN WATER DISTRIBUTING SYSTEMS

- 0.5 mg/litre - at all sampling points in a piped water system
- 1.0 mg/litre - at standpost
- 2.0 mg/litre - in tanker trucks at filling

CHLORINATION OF DRINKING WATER

PREPARATION OF STOCK SOLUTION

(1% solution in 1 litre of water)

Add to one litre of water any of the following:

- calcium hypochlorite (70%) — 15 gram

OR

- bleaching powder or chlorinated lime (30%) — 33 gram

OR

- sodium hypochlorite (5%) — 250 ml

OR

- sodium hypochlorite (10%) — 110 ml

The stock solution should be used within one month. It should be kept in a closed container in a cool place away from light

CHLORINATION OF WATER

(Add stock solution to water)

- 0.6 ml or 3 drops — 1 litre of water
- 6 ml — 10 litres of water
- 60 ml — 100 litres of water

Allow water to stand for 30 minutes before using. The residual chlorine level should be 0.2 to 0.5 mg/litre

DOMESTIC CHLORINATION OF DRINKING WATER

- crush commercially available chlorine-releasing tablet
- put in the water container with 20 litres of water
- allow to stand for 30 minutes
- use water within 24 hours

Containers with a narrow mouth are recommended for the storage of drinking water.

Annex 5

Composition of ORS (net weight = 27.9 gm)	
Ingredient	**Weight (gm)**
Sodium Chloride IP	3.5
Potassium chloride IP	1.5
Sodium citrate IP	2.9
Glucose anhydrous IP	20.0

Note:-To be used in one litre of potable water.

Annex 6

HOW TO PREPARE ORS SOLUTION FROM A 1 LITRE PACKET

- Mothers must be taught on how to measure one litre of water. It is important that a measure which is commonly available in the homes is identified and mothers told the exact number of such measures that will make 1 litre.

- There is no need to boil water for preparing the ORS solution. Clean water which the household normally uses for drinking purposes can be used.

- Hands must be washed before making the ORS solution.

- Full packet of ORS must be used. Generally the mother will tend to save a part of the packet in order to use it later. It is important to emphasise that the whole packet is to be mixed in one litre of water.

- The container should be kept covered. The solution can be used for 24 hours and should be discarded if not consumed within this period. Fresh solution should be prepared, if required.

INTER DEPATMENTAL COMMITTEE
SUGGESTED AREAS OF RESPONSIBILITY AND ACTION

District administration

- mobilize resources by organizing meetings with
  - concerned government departments
  - non-governmental agencies
  - community leaders
- ensure supplies of ORS packets and other essential items
- ensure adequate quality monitoring of water samples
- arrange safe water supply
- ensure adequate facilities for transportation of serious patients to district hospital, if necessary
- provide relevant information to the press
- monitor status of control activities
- repair leakage in pipe water supply

District Health Office / Municipal Health Office

- alert health personnel to report cases and to monitor trends
- arrange active surveillance in affected area
- ensure that treatment guidelines are followed in hospitals and other health facilities
- ensure availability of ORS packets and other essential items
- arrange health educational camps and distribution of health educational material
- arrange chlorination of water sources if possible
- arrange water quality monitoring
- convene meeting under district administrator to seek co-operation of other government departments and NGOs

Concerned Department (s) responsible for water supply

- repair leakage in pipe water supply
- arrange potable water supply, including water tankers if necessary
- arrange chlorination of water
- ensure water quality monitoring

Other government departments such as social welfare, education, tribal welfare and NGOs

- dissemination of relevant information
- promotion of oral rehydration therapy
- reporting clustering of acute diarrhoea, jaundice (*Pilia*) cases

Panchayat members, village pradhans, community leaders

- dissemination of relevant information
- promotion of oral rehydration therapy
- reporting cases of acute diarrhoea and jaundice (*pilia)*
- monitoring chlorination of water sources such as wells
- arranging transportation of serious cases to hospital

FORMAT FOR OUTBREAK INVESTIGATION REPORT

General Information

tate :_____
istrict :_____
own/PHC :_____
Vard/Village :_____
opulation :_____

Background Information

Person reporting the outbreak :_____
Date of report :_____
Date investigations started :_____
Person(s) investigating the outbreak _____

Details of Investigation

Describe how the cases were found (may include: (a) house-to-house searches in the affected area; (b) visiting blocks adjacent to the affected households; (c) conducting record reviews at local hospitals; (d) requesting health workers to report similar cases in their areas, etc.):

_____
_____
_____
_____
_____

Descriptive Epidemiology

I. Cases by time, place and person (attach summary tables and relevant graphs and maps).
II. Age-specific attack rates and mortality rates
III. High-risk age-groups and geographical areas.

Description of Control Measures taken

_____

Description of Measures for Follow-up Visits:

_____
_____
_____

Brief Description of Problems encountered

_____

_____

_____

Factors which, in your opinion, contributed to the Outbreak

_____

_____

_____

Conclusions and Recommendations

_____

_____

_____

Date

(Name and Designation)

Note: This report should be submitted by the investigating officer (State/District/PHC Nodal Officer) to the next higher authority within a week of completion of investigation. Tables and Graphs should be included wherever appropriate.

Teaching module No. 4

INVESTIGATION & CONTROL OF 0UTBREAKS

VIRAL HEPATITIS

National Disease Surveillance Programme
Directorate of Health & F. W. Services
Bangalore-560 009, Govt. of Karnataka

INVESTIGATION & CONTROL OF OUTBREAKS

VIRAL HEPATITIS

NATIONAL INSTITUTE OF COMMUNICABLE DISEASES
(DIRECTORATE GENERAL OF HEALTH SERVICES)
22-SHAM NATH MARG, DELHI - 110 054

1998

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1. Notification of cases

1.1. Hepatitis is an acute infection of the liver caused by hepatitis virus. There are six types of hepatitis virus - A, B, C, D, E and G. Although clinical picture is similar and the type of virus can only be confirmed by laboratory tests, there are differences in modes of transmission, incubation period, long-term complications and mortality rates.

1.2. Based on clinical diagnosis, around 100,000 cases of viral hepatitis are reported annually. The numbers reported is a gross under-estimate of the actual annual incidence of the disease. It is important that the surveillance system is improved as this is necessary for early identification of an outbreak (viral hepatitis E) or potential high risk areas, groups, behaviour and practices such as use of unsterile syringes and needles (hepatitis B & C).

1.3. Cases of viral hepatitis must be reported monthly to the Central Bureau of Health Intelligence through the concerned state health officer. A report may be endorsed to the Director, National Institute of Communicable Diseases (NICD), 22 Shamnath Marg, Delhi - 110 054 (Phone:-2521272, 2521060, 2913148; FAX:-2922677; Telegram:- COMDIS, DELHI).

1.4. If there is a sudden increase or clustering of cases or deaths due to viral hepatitis, information must be notified immediately (particularly by telephone or fax) to the next higher level. The district officer must similarly inform the concerned state officer immediately. If an outbreak is confirmed, NICD should be notified.

2. Causative agent

There are at least six viruses which can cause viral hepatitis. These viruses are hepatitis virus A, B, C, D, E and G.

3. Reservoir

Man seems to be the only natural host for HAV to HDV. However, these viruses can be transmitted experimentally to chimpanzees. Reservoirs of HEV and HGV are unknown. Humans as well as nonhuman animals are possible reservoirs for HEV; HEV is transmissible to chimpanzees, pigs, tamarins and cynomolgus macaques.

Chronic carriers are absent in hepatitis A and Hepatitis E. Hepatitis B, C, D, and G can lead to persistent infections (chronic carriers). These chronic carriers can transmit the disease to others.

4. Mode of Transmission

HAV and HEV are transmitted by faeco-oral route through contamination of water and food. Important mechanisms of transmission of HBV are mother to infant in perinatal period, parenteral (through infected needles and syringes, blood transfusion), and sexual routes. Intimate physical contact especially in infants and children has also been postulated to cause transmission of HBV infection. HCV is usually transmitted by parenteral route; the risk of transmission by household contact and sexual activity appears to be very low. HDV which needs the presence of HBV for its multiplication is transmitted like HBV. Only limited information is available for HGV; this virus can certainly be transmitted by parenteral route.

MODE OF TRANSMISSION

Hepatitis A & E

- Faecal-oral

Hepatitis B

- contaminated blood and blood products
- contaminated (unsterile) syringes and needles
- unsafe sex
- perinatal
- intimate physical contact between children or mother & child

Hepatitis C, D & G

- contaminated blood and blood products
- contaminated (unsterile) syringes and needles
- ?

5. Incubation period

Agent	Range	Average
HAV	15-50 days	28-30 days
HBV	15-180 days	60-90 days
HCV	15-180 days	45-60 days
HDV	20-140 days	15-60 days
HEV	15-65 days	25-45 days

CHARACTERISTICS OF DIFFERENT TYPES OF VIRAL HEPATITIS

VIRUS	HAV	HBV	HCV	HDV	HEV
Transmission	Faecal-oral	Parenteral	Parenteral	Parenteral	Faecal-oral
Average Incubation Period (days)	28-30	60-90	45-60	15-60	25-45
Epidemics	Occasional	Recently documented	No	No	Yes
Homologous immunity	Yes	Yes	?	Yes	?
Chronic carrier	No	Yes	Yes	Yes	No
Chronic hepatitis	No	Yes	Yes	Yes	No
Liver Cirrhosis	No	Yes	Yes	Yes	No
Liver Cancer	No	Yes	Yes	?	No

6. Clinical manifestation and case definition

6.1. In majority of the cases, especially in young children, the infection is mild with no overt signs or only mild jaundice. In moderate to severe cases, the onset is usually acute with fever, loss of appetite, feeling of general ill-health and abdominal discomfort, followed within a few days by jaundice. Fever is present or precedes jaundice. Right upper quadrant abdominal tenderness and hepatomegaly are important findings. Liver function tests include a raise in ALT to 8 times or more than normal levels and serum bilirubin to more than 2mg%.

6.2. Hepatitis B, C and D can lead to persistent infection (chronic carriers). The sequelae of persistent infection include chronic active hepatitis, liver cirrhosis and liver carcinoma. Around 3 to 5% of our population are estimated to be chronic carrier of hepatitis B. This data is mainly based on institutional studies.

6.3. The public and the paramedical personnel can assist in reporting cases whom they can recognise by the yellow colouring of the eyes and skin (*pilia*). Active case finding is particularly important during the investigation of an outbreak.

6.4. Definitive diagnosis by type of hepatitis virus can be made only by laboratory tests.

CASE DEFINITION

SUSPECT

- yellow colouring of the skin and eyes (*pilia*)

PRESUMPTIVE/CONFIRMED

- acute onset
- jaundice
- fever usually precedes jaundice. May be present when jaundice appears
- malaise, anorexia
- hepatomegaly and abdominal tenderness in the right upper quadrant
- increase of ALT >8 times and serum bilirubin >2mg% in clinically compatible illness
- epidemiological link or outbreak in the area of residence of case

Serological test are necessary for confirmaiton of types of viral hepatitis viz. A,B,C,D,E & G.

6.5. It would also be useful to know if:

- there are any other laboratory confirmed cases in area

OR

- there is a clustering of cases clinically compatible with viral hepatitis

Any one of the two above will support the presumptive diagnosis of viral hepatitis and type of virus. It would also facilitate better understanding of the epidemiology of disease and institution of appropriate control measures.

6.6 Clinical features in specific types of viral hepatitis

6.6.1 Hepatitis A is usually mild in children, but can be very severe in adults. However, almost all the children in India develop immunity following sub clinical repeated exposure to this virus before 10 years of age. The disease is hence rare in adults. Hepatitis A characteristically has an acute, sudden, influenza-like onset with a prominence of myalgia, headache, fever, and malaise. This type of onset is less common with other forms of viral hepatitis, which tend to have a more gradual, insidious onset. Hepatitis A usually is not as severe or as long lasting as Hepatitis B. Hepatitis A does not lead to a chronic hepatitis or a carrier state; chronic hepatitis with persistence of HAV infection for more than 12 months has not been observed. Morbidity from Hepatitis A is not higher in pregnant women than in non-pregnant women of the same age, nor is the course of Hepatitis A during pregnancy usually different, and foetal malformations due to Hepatitis A have not been reported.

6.6.2 Onset of hepatitis B is usually insidious with anorexia, vague abdominal discomfort, nausea and vomiting, sometimes arthralgias and rash, often progressing to jaundice. Fever may be absent or mild. Hepatitis B has a more prolonged course than hepatitis A. Chronic liver disease due to HBV (chronic hepatitis, liver cirrhosis, and liver carcinoma) occur only in persons who become chronic HBsAg carriers. Protective immunity follows the infection if antibody to HBsAg (anti-HBs) develops and HBsAg becomes negative.

6.6.3 Hepatitis C clinically resembles hepatitis B. However, it tends to be milder during the acute phase and tends to progress to chronicity much more frequently than hepatitis B. Subclinical HCV infections predominates. There is usually episodic fluctuation of ALT.

6.6.4 Clinically HDV infection, whether acute or chronic, tends to be a severe illness. Although only some of HBV infections cause icterus, most of the HDV infections (co-infection or super infection) cause an episode of clinical acute hepatitis with jaundice. The risk of fulminant disease may reach 10% for clinical HDV-HBV coinfections and 20% in HDV superinfections.

6.6.5 The clinical course of Hepatitis E is similar to that of Hepatitis A. More than 50% of HEV infections may remain anicteric. The expression of icterus appears to increase with increasing age. There is no evidence of a chronic form. A majority of Hepatitis E cases occur in young adults. Secondary household cases during the outbreaks are uncommon. The case fatality rate is also similar to that of HA, except in pregnant women where the CFR may reach 20% among those infected during the 3rd trimester of pregnancy.

6.6.6 HGV has been recently discovered. Its circulation in India has been demonstrated. HGV has been linked to acute and chronic hepatitis. The majority of individuals infected with HGV do not have clinical evidence of liver disease.

6.7. Case fatality rates for hepatitis A and E infections are generally low. Viral hepatitis may cause serious illness in pregnant women. High CFR (up to 20%) has been seen in pregnant women having hepatitis due to HEV. Case fatality rate for hepatitis B infection for hospitalised cases is around 1%; higher in those over 40 years of age. The case fatality rate increases if there is concurrent infection of hepatitis B and D viruses.

7. Laboratory confirmation of diagnosis

7.1. Acute viral hepatitis is such a sufficiently distinct clinical syndrome that it usually poses no difficulty in diagnosis. Clinical diagnosis is supported by:

(i) Elevation of ALT and AST ($\geq$8 times of normal), and mild elevation of alkaline phosphatase (usually only 3 times of normal).

(ii) Exclusion of nonviral causes of acute hepatitis (e.g. Bacteria- Leptospirosis; Drugs- Anti-tubercular drugs, acetaminophen; Toxins and Non-specific Injury).

7.2. The type of virus causing hepatitis can be identified by laboratory tests only.

LABORATORY DIAGNOSIS OF SPECIFIC TYPES OF VIRAL HEPATITIS BY SEROLOGY
• Acute Hepatitis A virus infection - IgM HAV positive • Acute Hepatitis B virus infection - IgM HBc and HBsAg positive • Chronic hepatitis B virus infection (chronic carrier) - HBsAg alone positive • Acute Hepatitis E virus infection - IgM HEV positive • Acute or chronic Hepatitis C virus infection - Anti HCV positive

7.3 Most of the diagnostic kits are imported, expensive and require an ELISA reader. The cost of some of the kits (especially for hepatitis C, hepatitis D and hepatitis E) is around Rs 30,000 and unit cost of each test may vary from Rs 200 to 600. Carrier rates for hepatitis B can be determined by testing the blood using a similar technique and the reagents are less costly. Unit cost varies from Rs 15 to Rs 35.

7.4. Treatment of viral hepatitis does not depend on the results of laboratory examination. However, laboratory analysis of specimens from the first few suspected cases during the outbreak is important to confirm diagnosis and to determine the characteristics of the organism. Once the hepatitis virus is confirmed, ***it is not necessary to examine specimens from all cases or contacts***. In fact, this should be discouraged since it places an unnecessary burden on laboratory facilities and is not required for effective treatment.

7.5. Serum specimens should be sent to the laboratory as early as possible, preferably in cold chain. If delay is inevitable in transporitng the samples to laboratory, they should be stored at +2 to +8° C. Specimens should be stored and transported in sterile screw capped vials.

7.6. Full particulars of the patient(s) from whom samples have been collected must be sent along with the samples as many factors can influence the results of the laboratory tests. The information that should accompany each serum sample is given below:

- name
- name of mother or father
- sex
- date of onset of symptoms
- provisional diagnosis
- clinical outcome (recovered, under treatment, dead, not known)

- date sample collected
- full address

7.7. The conditions of collection and transportation of samples can influence laboratory tests. The recommended practices and precautions to be taken to minimise deterioration in the quality of the sample is given in the box.

COLLECTION AND TRANSPORTATION OF SAMPLES
• collect the blood sample from a few patients with clinical/frank jaundice • use a sterile syringe and needle for drawing blood. Practise universal infection control safety precautions. • Separate serum and keep in a sterile screw capped vial. • Serum specimens should be sent to the laboratory as early as possible, preferably in cold chain. If delay is inevitable in transporitng the samples to laboratory, they should be stored at +2 to +8° C. Specimens should be stored and transported in sterile screw capped vials. • bottles should be placed in separate plastic bags each to prevent leakage of the potentially contaminated material. • each sample should be labelled. Detailed information as indicated at 7.6 should be sent for each sample.

7.8. Keep an inventory of the referral laboratories which can undertake laboratory tests for all markers of viral hepatitis.

7.9. The National Institute of Communicable Diseases (NICD), Delhi has the facilities for testing all markers of viral hepatitis. This support is available for investigation of outbreaks provided samples are accompanied by comprehensive details of outbreak and information indicated at 7.6.

8. Clinical Management

- There is no specific treatment. Patient requires only supportive and symptomatic management.

- Ensure nutritious diet and adequate rest. However, strict bed rest is not required unless patient is acutely ill.

- Corticosteroids are not indicated.

9. Health Education

Outbreaks of viral hepatitis are usually caused by hepatitis E virus which spreads through contaminated water and food products. Outbreaks of hepatitis A are not frequent because HAV causes very mild or sub-clinical infection in children, and most of the persons in our country are exposed to this virus during childhood. However, we may see such outbreaks in future as many people may escape exposure during childhood due to improvement in hygiene and sanitation. The risk of outbreaks due to HEV is higher in the summer, monsoon and post-monsoon periods.

Since transmission of hepatitis A and E is faecal-oral, measures of personal hygiene and environmental sanitation that apply to control of other enteric infections are the basis for their control in any settings. There is no vaccine available for hepatitis E. Vaccine available against hepatitis A is not cost-effective due to epidemiological considerations and very high costs.

Hepatitis B, C and D viruses spread through body fluids of patients or carriers. General measures to prevent hepatitis B, C, D, and G include sterilisation of needles and instruments that penetrate the skin, screening of blood for hepatitis B and hepatitis C markers and promotion of safe sex behaviour. Vaccine is available against hepatitis B only.

Health education and public awareness and co-operation are important to prevent and control viral hepatitis. If the community knows how the disease spreads and what measures they can take in their own families, the risk can be considerably reduced. While the key messages will essentially remain the same for all areas, the language and style may be adapted to local needs. Suggested material or health education messages which can be adapted for local use is given at Annex 1.

10. Prevention and control of an outbreak

10.1. Almost all outbreaks of viral hepatitis in India are due to faeco-orally transmitted hepatitis E. An occasional outbreak of hepatitis A has also been reported. Although an unusual increase in viral hepatitis cases due to hepatitis B have been recognised in hospital setting, it had not been documented as the cause of an outbreak in community setting. However the NICD investigated 3 outbreaks of hepatitis B in 1997 which occurred due to the use of inadequately sterilised needles and

syringes by unqualified medical practitioners in the concerned areas.

10.2 Outbreaks of hepatitis E are due to contamination of water supply. Measures to prevent and control these outbreaks should be directed towards ensuring safe water supply.

PREVENT WATER-BORNE DISEASES BY

- provision of safe water
- adopting safe practices in food handling
- sanitary disposal of human waste

10.3. Majority of the outbreaks have occurred due to contamination of pipe water supply. Clustering of cases in some area linked to a common water supply will help in identifying the points where the contamination is taking place. Repair of water pipe lines at these points will prevent the further spread of Hepatitis E.

10.4 Alternate arrangement for safe water supply should ideally be made during the outbreak. Simultaneously, source of contamination should be removed on priority. If the local water sources are still used, the community should be advised to boil the water. **Hepatitis E virus is not destroyed by chlorination in usual doses; the virus is killed by boiling.**

10.5 All human excreta should be disposed of promptly and safely.

10.6 Whether the outbreak is due to hepatitis A or E, the measures for prevention and control are similar. These measures should be applied immediately.

10.7. If an outbreak of hepatitis B occurs, identification and removal of risk factor/s will control the outbreak.

10.8. Ensuring safe injections and screening of all blood donations for hepatitis B (and if possible hepatitis C) will largely prevent all the parenterally transmitted infections including hepatitis B, C, D and G. National AIDS Control Programme takes measures to promote safe sex behaviour to prevent HIV infection. These measures will also contribute towards the prevention of hepatitis B and other parenterally transmitted viral hepatitis.

ACTION TAKEN FOR PREVENTION OF HEPATITIS B INFECTION
• mandatory testing of blood in all blood banks • promotion of safe sex behaviour under the National AIDS control programme • health awareness campaigns regarding the dangers of using unsterile syringes and needles under the immunisation programme and National AIDS Control Programme • guidelines have been issued to the state health authorities for the use of a separate sterile syringe and needles for each injection • immunization of health personnel in hospitals against hepatitis B

10.9 Hepatitis B vaccine

There are two types of hepatitis B vaccines available - the recombinant DNA vaccine and the plasma derived. Both are safe and effective. They should be administrered as per recommendations by manufacturers. These vaccines are available in single and multi-dose vials.

10.10 When an outbreak occurs or when the risk of such outbreaks is high, the cooperation of other government departments, non-governmental agencies and the community often becomes necessary. Such help will be more forthcoming if mechanisms for interaction have been developed before the onset of an outbreak. It might be useful to convene a meeting of the concerned departments, community representatives and the NGOs before the expected seasonal increase of cases of diarrhoeal diseases. Some mechanism for briefing the press should also be established. Some suggested areas in which the government departments and NGOs can assist may be seen at Annex 2.

11. Preparatory action in anticipation of an outbreak

11.1 Maintain surveillance for acute diarrhoea, typhoid fever, and jaundice cases. Viral hepatitis E has a long incubation period of usually 1-2 months (not less than 15 days). There are other diseases which have shorter incubation period and are also transmitted by faeco-oral route. They are acute watery diarrhoea (incubation period: a few days) and typhoid fever (incubation period: 1-3 weeks). By analogy, viral hepatitis E is likely to follow an increase in acute diarrhoea or typhoid fever following water contamination.

Describe cases by time, person and place to identify any clustering of cases in an area or group.

11.2. Regular monitoring of water quality by examination of water samples for residual chlorine and/or coliform organisms on a random basis.

11.3 An increase in the incidence of diarrhoea and/or typhoid fever, and poor water quality indicate impending epidemic of viral hepatitis. Manage the existing increase in diarrhoea and/or typhoid fever cases, and take corrective measures to prevent the impending outbreak of viral hepatitis.

11.4. Periodic sanitary surveys should be undertaken, especially before monsoon, for sewer overflow, and leakage in water supply system. If any leakage is found, it should be attended to on priority. In areas where water supply is intermittent, on-line-booster pumps can create negative pressure in the pipeline leading to suction of sewage into the water pipeline.

11.5. Prepare/update inventory of existing and required resources if outbreak strikes.

11.6. IEC activities for minimising the risk of faeco-orally transmitted diseases should be undertaken in the community.

11.7 To prevent faeco-oral transmission, supply of safe water, environmental sanitation, and personal and domestic hygienic practices should be applied.

12. Investigation of an outbreak

12.1 Establish the existence of an outbreak:

Surveillance for jaundice cases (institutional surveillance-supported by surveys if necessary) to find out the existence of outbreak - rule out any seasonal increase.

12.2 Confirmation of diagnosis:

Acute viral hepatitis is such a sufficiently distinct clinical syndrome that it usually poses no difficulty in diagnosis. However, specific blood tests are needed to diagnose different types of viral hepatitis. See Box under 7.

Collect and transport the blood samples as given in the box under-7.

12.3 Characterise the outbreak in terms of time, person and place.

Geographical distribution-Identify the area or group affected by the outbreak-attack rates in different areas will indicate the points where contamination is occurring.

12.4 Carry out a sanitation survey-find out the leakage points.

12.5 Institute the control measures

(i) Repair of the water and sewer lines - close co-ordination with public health engineering department - safe disposal of human excreta.

(ii) Disinfection of water - boiling (chlorination does not inactivate HEV). Chlorination of water sources to prevent the transmission of agents of acute diarrhoeal and typhoid fever. Frequent water quality monitoring.

(iii) IEC to prevent the spread of infection.

(iv) Standard measures to prevent faeco-oral transmission.

(v) Arrangement for management of the existing cases.

(vi) Supply of ORS for acute diarrhoea, and antibiotics for typhoid fever.

12.6 In case the CFR is very high, hepatitis B should also be suspected. Data should be analysed for the risk factors of viral hepatitis B. All the 3 outbreaks of hepatitis B investigated by the NICD during the first half of 1997 were due to the use of unsafe injections by unqualified medical practitioners. Removal of the risk factor/s will prevent the further spread of the infection.

12.7 Notify the state nodal officer about the outbreak.

12.8 Write outbreak investigation and action taken report. Send a copy to the concerned state authorities as well as to NICD.

PROTECT YOURSELF FROM VIRAL HEPATITIS BY

- drinking water from a safe source
- not eating cut fruits and vegetables from the market
- cleaning thoroughly fruits and vegetables which are eaten raw
- storing drinking water in a clean, covered and narrow-mouthed container
- eating cooked food while it is still hot
- washing hands before eating and after using the toilet
- avoiding use of on-line-booster pumps which can suck sewage in water line
- reporting to municipal authorities broken water pipes
- reporting cases(s) of JAUNDICE (*PILIA)* to the nearest health centre or local health officer

HOW CAN YOU PROTECT YOURSELF FROM HEPATITIS B

AVOID

- unsterile syringes and needles
- other unsterile sharp instruments
- transfusion with unscreened blood
- unsafe sex

PROTECT YOURSELF FROM PARENTERALLY TRANSMITTED VIRAL HEPATITIS BY

- ensuring that a separate sterile syringe and needle is used for each injection. Insist that a glass syringe and needle are boiled for 20 minutes before reuse OR a sealed disposable syringe and needle is used
- taking injections only when medically indicated. Take treatment from qualified personnel only
- using condoms. Avoid unsafe sex and extra-marital sexual contacts
- getting blood from a registered blood bank. Promote voluntary blood donation and donate blood
- reporting JAUNDICE (*PILIA*) case (s) to the nearest health centre or local health officer
- hepatitis B vaccine is available in the market. Contact your physician for further guidance.

PROTECT YOURSELF FROM UNSAFE INJECTIONS BY

- ensure that a separate sterile syringe and needle is used for each injection. Insist that a glass syringe and needle are boiled for 20 minutes before reuse OR a sealed disposable syringe and needle is used
- take injections only when medically indicated
- take treatment from qualified personnel only

Your life is precious. Say No to unsafe Injections

INTER-DEPARTMENTAL COMMITTEE
SUGGESTED AREAS OF RESPONSIBILITY AND ACTION

District administration

- mobilize resources by organizing meetings with
  - concerned government departments
  - non-governmental agencies
  - community leaders
- ensure adequate quality monitoring of water samples
- repair of leakage in water pipe lines
- arrange safe water supply
- ensure supplies of ORS packets and other essential items
- ensure adequate facilities for transportaion of serious patients to district hospital, if necessary
- strengthening of existing provision under the Drug & Cosmatic Act to curtail over the counter sale of parenteral drugs
- provide relevant information to the press
- monitor status of control activities

District Health Office / Municipal Health Office

- arrange repair of leakage in water pipe lines
- alert health personnel to report cases and to monitor trends
- arrange active surveillance in affected area
- ensure that treatment guidelines are followed in hospitals and other health facilities
- ensure availability of ORS packets and other essential items
- strengthening of existing provision under the Drug & Cosmatic Act to curtail over the counter sale of parenteral drugs
- arrange health educational camps and distribution of health educational material
- arrange chlorination of water sources if possible
- arrange water quality monitoring
- convene meeting under distrist administrator to seek cooperation of other government departments and NGOs
- check sterilisation practices of medical practitioners for syringes, needles and sharp instruments

Concerned Department (s) responsible for water suppy

- repair of leakage in water pipe lines
- arrange potable water supply, including water tankers if necessary
- arrange chlorination of water
- ensure water quality monitoring

Other government departments such as social welfare, education, tribal welfare and NGOs

- dissemination of relevant information
- promotion of oral rehydration therapy
- check sterilisation practices of medical practitioners
- reporting cases of jaundice (*pilia*)

Panchayat members, village pradhans, community leaders

- dissemination of relevant information
- promotion of oral rehydration therapy
- check sterilisation practices of medical practitioners
- reporting cases of *pilia*
- monitoring chlorination of water sources such as wells
- arranging transportation of serious cases to hospital

FORMAT FOR OUTBREAK INVESTIGATION REPORT

General Information

State :_____

District :_____

Town/PHC :_____

Ward/Village :_____

Population :_____

Background Information

Person reporting the outbreak :_____

Date of report :_____

Date investigations started :_____

Person(s) investigating the outbreak _____

Details of Investigation

Describe how the cases were found (may include: (a) house-to-house searches in the affected area; (b) visiting blocks adjacent to the affected households; (c) conducting record reviews at local hospitals; (d) requesting health workers to report similar cases in their areas, etc.):

_____

_____

_____

_____

_____

Descriptive Epidemiology

I. Cases by time, place and person (attach summary tables and relevant graphs and maps).

II. Age-specific attack rates and mortality rates

III. High-risk age-groups and geographical areas.

Description of Control Measures taken

_____

Description of Measures for Follow-up Visits:

_____

_____

_____

Brief Description of Problems encountered

_____

_____

_____

Factors which, in your opinion, contributed to the Outbreak

_____

_____

_____

Conclusions and Recommendations

_____

_____

_____

Date (Name and Designation)

Note: This report should be submitted by the investigating officer (State/District/PHC Nodal Officer) to the next higher authority within a week of completion of investigation. Tables and Graphs should be included wherever appropriate.

PROFORMA FOR SURVEY FOR JAUNDICE CASES

Name of Surveyor_____ Date of Survey_____
District _____ City/Village_____
Street/Mohalla_____

House No.	Name of persons	Age/Sex	History of jaundice in past 6 months Yes/No	Currently having jaundice Yes/No	Jaundice Case Number

PROFORMA FOR JAUNDICE CASES

Surveyor's Name_____ Date of Survey_____ Jaundice Case No. _____
Name of case_____ Father's/Husband's Name_____ Sex: M/F
Age of Patient (in complete Years)_____ Ward No/Village._____
Address_____
If female, history of pregnancy when she had jaundice: Yes/No/do not know

If case is a child <15 Years then ask :
Education of Mother_____ Education of Father _____
Occupation of Mother_____ Occupation of Father_____

Information about Family for all Jaundice cases :
No. of Family Members_____ No. of members had jaundice in past 6 months (excluding index case)___
Source of drinking water: Tap/Hand pump/Well/other (speciíy)
Storage of drinking water: Bucket/Pitcher/Surahi/Vessel with Tap/other
Method of drawing drinking water: Tap/Ladle/other
Type of Latrine: Open field/Service/Sanitary/Community latrines
Hand washing after defecation: Soap/Ash/Earth/Water alone/did not wash
Hand washing before meals: Soap/Ash/Earth/Water alone/did not wash

Information about Illness for all Jaundice cases:
Date of Onset of Jaundice_____ Outcome: Still Ill/Recovered/Died
Symptoms Present (circle): Dark Urine, Yellow Eyes, Anorexia, Nausea, Vomiting, Pain abdomen, Fever, Clay coloured stool, Malaise, Itching, Others (Specify)_____
Liver palpable: Yes/No/not examined
Any Treatment taken for Jaundice: Yes/No
If Yes, the type of treatment: Allopath/Ayurved/Homeopath/Other (specify)
Past history of jaundice before this episode : Yes/No

History within 6 months but 15 days prior to onset of jaundice for the following points:

Hospital Admission due to any cause: Yes/No
Multiple Injections: Yes/No
Surgical Operation: Yes/No
Dental Surgery: Yes/No
Blood Transfusion: Yes/No
Dialysis: Yes/No
Intravenous Drip: Yes/No
Blood Donation: Yes/No
Vaccination (Specify): Yes/No
Tattooing: Yes/No
Nose/ear pricking: Yes/No
Shave from a barber: Yes/No
Drug addiction: Yes/No
Alcoholism: Yes/No
Extramarital sexual contact (adult): Yes/No
Movement outside the village: Yes/No
Contact with a case in the family: Yes/No
Contact with a case in the Community: Yes/No
Contact with a case outside the village: Yes/No

Any chronic illness_____
Drug history_____
Diagnosis by a Doctor_____

Investiagtions already done:
S.bilirubin_____ SGOT_____ SGPT_____ Urine_____HbsAg_____

Blood Sample collected: Yes/No
(Collect Blood Sample if the patient had jaundice in the last 3 months)
Blood sample No._____

Remarks

Teaching module No. 5

INVESTIGATION & CONTROL OF OUTBREAKS

JAPANESE ENCEPHALITIS

National Disease Surveillance Programme
Directorate of Health & F. W. Services
Bangalore-560 009, Govt. of Karnataka

INVESTIGATION & CONTROL OF OUTBREAKS

JAPANESE ENCEPHALITIS

NATIONAL INSTITUTE OF COMMUNICABLE DISEASES
(DIRECTORATE GENERAL OF HEALTH SERVICES)
22-SHAM NATH MARG, DELHI - 110 054

1998

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1. Introduction

1.1. Japanese Encephalitis (JE) is a disease of public health importance because of its epidemic potential and high case fatality rate. In patients who survive, complications may lead to life long sequelae.

1.2. The first major outbreak of JE occurred in Bankura and Burdwan districts, West Bengal, in 1973 and since then it has spread to many states/UTs of country.

1.3. JE is a mosquito-borne zoonotic disease. The virus infects mainly animals and birds. Man is an incidental host. The risk increases in areas where ecological conditions facilitate transmission to man.

1.4. Though JE is primarily a disease of rural agricultural areas, where vector mosquitoes proliferate in close association with pigs and other animal reservoirs, its epidemics have also been reported in peri-urban areas where similar conditions may exist.

2. Notification of cases

2.1. If an outbreak of JE is suspected it must be reported immediately to the district health office. The state health authorities must be informed through the quickest mode of communication, preferably through telephone, fax or e-mail of the details of the outbreak including investigation and control measures initiated. The National Institute of Communicable Diseases, 22-Sham Nath Marg, Delhi - 110 054 (Phone:- 2521272, 2521060, 2913148; FAX:- 2922677; Telegaram:- COMDIS, DELHI) is expected to be kept informed of the action taken.

2.2. The total number of overt cases per village will be a few and the local health personnel must be alert about any case(s) of encephalopathy in their areas. Active surveillance through key individuals in the community should be encouraged in the high risk pockets, for example, places where piggeries are commercially established.

3. Causative agent

3.1. JE is caused by a group B arbovirus (flavivirus). The virus is antigenically related to other flaviviruses including dengue and yellow fever viruses.

4. Mode of transmission

4.1. The infection is transmitted through the bite of an infected culicine mosquito. In human beings, viraemia is mild and lasts for a short duration. Infection in man is the dead end of transmission. Man to man transmission has not been documented.

4.2. The transmission cycle is maintained in animals and birds.

5. Reservoir of infection

5.1. JE virus has its natural cycle in wild or domestic vertebrates and mosquitoes. The animal hosts include pigs, cattle and horses. Water birds such as pond herons, cattle egrets, poultry birds and ducks play a significant role in the natural history of JE virus.

5.2. Pigs are the major vertebrate hosts. Although, infected pigs do not manifest any overt symptoms of disease they develop tremendous viraemia and can infect the mosquitoes **The pigs are considered as amplifying hosts**.

5.3. The currently available evidence does not indicate major role of cattle in transmission of disease.

5.4. Horses develop active disease but viraemia is rarely present in high titre or for long periods. Horses are unlikely source of mosquito infection.

5.5 Infection in man appears to be correlated with living in close proximity with animal reservoirs, especially pigs

6. Vector

6.1. Mosquitoes belonging to the *Culex vishnui* group (*Culex vishnui, Culex pseudovishnui, Culex tritaeneorhynchus*) are the most important vector species in India. 11 more species of mosquito have been incriminated as vectors of JE.

6.2. Culex mosquitoes generally breed in water bodies with luxuriant vegetation. Irrigated rice fields, shallow ditches and pools are common breeding places.

6.3. Culex mosquitoes are zoophilic, feeding primarily on animals and wild birds. They rest outdoors in vegetation and other shaded places but in summer may also rest indoors. The mosquitoes are outdoor as well as indoor feeders.

6.4. Epidemics usually coincide with the monsoons and post-monsoon period when the vector density is high. However, in endemic areas, sporadic cases may occur throughout the year.

6.5. Female mosquitoes get infected after feeding on a viraemic host. They can transmit the virus to other hosts after an extrinsic incubation period of 9 to 12 days. The mosquitoes remain infected for life. The average life period of a mosquito is about 21 days. Culex mosquitoes can fly for long distances (4-5 km).

7. Incubation period

7.1. The incubation period in man, following mosquito bite probably varies from 5 to 15 days.

8. Clinical manifestations

8.1. The clinical features of JE are those of encephalopathy. The patient will give a history of acute onset with fever and change in behaviour or sensorium lasting for more than 24 hours. Focal neurological deficits may or may not be present.

8.2. Disturbances of sensorium are reflected as lethargy, somnolence, irritability, apathy or loss of consciousness. The patient may develop difficulty of speech and other neurological deficits like ocular palsies, hemiplegia, tremor and ataxia. There may also be loss of bladder and bowel control. The focal neurological signs may be stationary or progressive.

CLINICAL LABORATORY FINDINGS IN ACUTE ENCEPHALITIC STAGE
Blood: moderate to high polymorph leucocytosis (total count ranging between 10,000 and 35,000 per cu.mm with neutrophils ranging between 50 and 90%).
Cerebrospinal fluid (CSF): the cell count generally ranges between 10 to 1000 per cu.mm. with a predominance of lymphocytes. The protein may be raised slightly to 60-100 mg percent and sugar may also be slightly elevated.

8.3. In majority of the cases, however, the infection is mild with no overt clinical symptoms or mild fever with headache. Individuals develop immunity after infection. In endemic areas cases are, therefore, seen more often in children under 15 years of age as the adult population is already immune through natural infection. In virgin areas, cases may be seen in all age groups.

8.4. Meningitis should be excluded as a cause of the encephalitic syndrome, so that specific treatment is started in time. Treatment of JE, which is a viral infection, is symptomatic. Other causes of encephalopathy include other viral infections, drugs and toxins. Some of the causes are listed in the box.

8.5. One of the complications of malaria caused by *P.falciparum* is encephalopathy. Since malaria is relatively common, the diagnosis of malaria should also be considered. The diagnosis is probable if field investigations indicate malariogenic conditions, illness is clinically compatible and anti-malaria treatment is effective. The facilities for making blood slides and reading these slides should be available at each PHC.

8.6. Typhoid fever is another important endemic disease which can give rise to symptoms mimicking Japanese Encephalitis. It should be excluded by careful history and physical examination and blood culture for *S.typhi*, if necessary.

COMMON CAUSES OF ENCEPHALOPATHY	
Infectious	
• Vaccine Preventable Diseases	Pertussis, measles
• Viral	Japanese encephalitis, mumps, rubella, herpes simplex, enteroviruses, cytomegalovirus, Epstein Barr, rabies
• Other	Enteric fever, malaria, tuberculosis, toxoplasmosis, cryptococcal infection, leptospirosis
Non-infectious	
• Fluid & electrolyte imbalance	Hyper/hyponatremia Alkalosis/acidosis
• Metabolic	Thiamine deficiency, diabetic acidosis, hypoxia, hypoglycaemia, uraemia, hyperbilirubinemia
• Toxic	Heavy metals (lead, mercury, arsenic) Insecticides, Carbon - Monoxide
• Physical	Heat hyperpyrexia
• Tumours/Abscess	

8.7. Epidemiological and entomological investigations are useful in leading to a presumptive diagnosis of JE. The presence of risk factors such as the vector and amplifying hosts supports the diagnosis of JE.

8.8. The diagnosis of JE is confirmed by laboratory tests.

8.9. Case definition may be seen at Annex 1.

9. Case fatality rate and sequelae

9.1. Case fatality rate is high in severe cases. Case fatality rates of 20 to 40% have been recorded.

9.2. Patients who recover from the acute episode may have neurological sequelae. These occur with variable frequency and depend on age and severity of the illness. The commonly observed sequelae are:

- mental impairment
- severe emotional instability
- personality changes
- paralysis

10. Laboratory confirmation of diagnosis

10.1. The diagnosis of JE can be confirmed by serological tests. The tests include detection of IgM antibodies which appear after the first week of onset of symptoms and are detectable for one to three months after the acute episode.

A fourfold rise in IgG antibody titre in paired sera taken at an interval of 10 days or more is confirmatory.

10.2. IgG antibodies indicate previous infection and are useful for conducting sero-epidemiological studies to determine the extent of silent infection and immunity levels in the local population.

10.3. Antigen for conducting the tests is not yet commercially available. Antigen for detection of IgG antibody is produced in limited quantities for operational research and outbreak investigations at the National Institute of Virology (20-A, Dr. Ambedkar Road, Pune - 411 001; Phone:-627301, 627302; FAX: 622669). With the antigen received from NIV, the National Institute of Communicable Diseases (NICD) supports outbreak investigations on the request from the state health authorities.

10.4. Isolation of virus from CSF is not routinely done for diagnostic purposes. Isolation of virus from blood is almost impossible as viraemia is mild and of short duration.

10.5. Blood for serological studies should be carefully collected taking due universal precautions. Specimen containers should be clearly labelled. Each specimen should be accompanied with the detailed information about the case as given in the box so that the results could be scientifically interpreted.

INFORMATION WHICH SHOULD ACCOMPANY EACH SAMPLE

- name of the patient
- name of the mother/father
- age
- sex
- complete residential address
- name of the hospital/PHC sending the sample
- registration number of the patient
- date of onset of illness
- date of hospitalisation
- date of collection of sample
- history of immunisation against JE
- provisional diagnosis
- brief clinical findings
- results of clinical laboratory investigations

11. Clinical management

11.1. There is no specific treatment of JE. However, supportive treatment and good nursing care can significantly reduce case fatality rate. It is, therefore, important that cases are referred to a hospital as early as possible if encephalitis is suspected and treatment commenced without waiting for serological laboratory results.

11.2. In the acute phase, clinical management is directed at maintaining fluid and electrolyte balance. Keeping the airway open in a comatose patient is important. Patients with hypoxia may require oxygen.

11.3. If the patient has convulsions, appropriate drugs are prescribed.

11.4. There is no evidence that gammaglobulins or corticosteroids have a beneficial effect and these are not recommended.

11.5. Physio-therapy may be necessary in the convalescent stage.

11.6. Long-term neurological sequelae may require specialised care.

12. Prevention and control of an outbreak

12.1. A surveillance system should be established so that any case of encephalopathy is immediately reported to the local health authorities. Necessary field investigations must be carried out in the area of residence of the patient to check for amplifying host and vector.

12.2. The preventive measures are directed at reducing the vector density and in taking personal protection to prevent the bite of mosquitoes. The isolation or destruction of the amplifying hosts (usually pigs), which are the main source of infection, is not practical as these animals do not show any overt signs of illness and it is not possible to identify infected animals.

12.3. Immediate measures are called for to reduce the density of mosquitoes by spray of insecticides. The public should also be informed to take necessary precautions against mosquito bite such as use of full sleeved clothes, mosquito nets at night and mosquito repellent creams.

12.4. Long-term measures include the recommended steps for vector control under the National Malaria Eradication Programme (NMEP).

12.5. Patients should be referred to the district hospital as the peripheral health facilities may not have adequate resources to manage serious cases.

12.6. Pockets of high risk should be identified so that these areas could be given more attention with regard to control measures, health educational activities and field supervision. Such areas would include villages and peri-urban areas where pigs are reared, especially if these are close to paddy fields which are rich breeding places for Culex mosquitoes.

12.7. Isolation of patients and disinfection of secretions and excretions are not required as JE virus is not transmitted person to person.

RECOMMENDED MEASURES FOR CONTROL OF JE OUTBREAK

- Vector control
- Prevention of man-mosquito contact
- Prevention of animal reservoir-mosquito contact
- Health education

12.8. A killed JE vaccine is produced at the Central Research Institute (CRI), Kasauli from the brain of suckling mice inoculated with the Nakayama JE strain. The vaccine is not recommended for use for the control of an outbreak. Two doses of 1 ml each (0.5 ml for children under the age of 3 years) should be administered subcutaneously at an interval of 7-14 days. A booster injection of 1 ml should be given after a few months (before 1 year) in order to develop full protection. Re-vaccination may be given after 3 years. Since the risk of JE is not universal and is limited to focal areas, JE vaccination is not included in the national immunization programme in India.

12.9. Arrange health educational activities in the community regarding prevention of mosquito bites by use of mosquito nets and mosquito repellent creams, avoiding sleeping in or near places where pigs are housed, taking measures like mosquito proofing, residual insecticide spray in piggeries and reporting suspected cases at the health facilities early.

13. Community Participation

13.1. Community participation is essential for the prevention and control of an outbreak of JE. The community must be encouraged to take steps to protect themselves from mosquitoes by using bed-nets. The co-operation of the community is also important during the periodic insecticide spray.

13.2. In pockets of high risk, active surveillance of JE should be encouraged so that first case(s) are immediately reported to the local health authorities.

13.3. Co-ordinated efforts by government departments such as agriculture, animal husbandry, flood control, irrigation and industrial development are essential so that risk factors for mosquito breeding could be reduced. In places where piggeries are being established with government support, the concerned departments must be aware about the potential risk of JE and must take necessary precautionary measures for vector control in collaboration with the local health authorities.

13.4. In an event of an outbreak, the co-operation of other government departments will help to bring it more effectively under control. An inter-departmental committee for outbreak prevention and control should be constituted which should meet periodically. Panchayat members, key community representatives and NGOs should be included as members of the committee. A meeting of the committee should be convened before the expected seasonal increase of water and vector borne diseases. In districts where risk factors of JE exist, status of control measures for JE should also be assessed. The suggested areas of responsibilities of the various departments is given at Annex 5.

13.5. Press release and other mechanisms for briefing the press should be considered so that the press has access to reliable information.

RISK FACTORS FOR JE OUTBREAK
• high density of Culex mosquitoes • presence of amplifying hosts (pigs) • paddy cultivation

14. Investigation of an outbreak

14.1. The investigation of an outbreak of JE is similar to the investigation of other epidemic prone diseases. The first principle is to receive early warning signals, confirm diagnosis and to take prompt measures for control of the outbreak. Control measures are most effective when selective measures are applied early.

14.2. Line list of cases, including age, sex and address should be maintained. Active search should be made for more cases. Serum samples should be collected for laboratory confirmation of diagnosis.

14.3. Vector surveillance should be immediately initiated and should include collection of adult mosquitoes, identification of mosquito species and density and assessment of susceptibility of vectors to available insecticides.

14.4. On confirmation of an outbreak of JE, take precautionary measures in other potentially high risk pockets in the district.

14.5. After the outbreak is over, a detailed report of the outbreak must be written. Format for outbreak investigation report given at Annex 2.

CASE DEFINITION

SUSPECT CASE

- High grade fever of acute onset with at least two of the following:
- Decrease in level of consciousness independent of convulsions
- Significant change in mental status either in behaviour or personality
- Convulsions

PROBABLE CASE

- Suspected case of Japanese Encephalitis, and
- Usually not more than a few cases (1-2) in one village.
- With or without signs of meningeal irritation and varying degree of neurological deficits

CONFIRMED CASE

- High IgM antibody titre
- Fourfold rise of antibodies in paired serum samples

Annex 2

OUTBREAK INVESTIGATION REPORT

General information

State :----------

District : ----------

PHC/Town :----------

Village/Ward :----------

Population :----------

Background Information

Person reporting the outbreak :----------

Date of report :----------

Date investigations started :----------

Person(s) investigating the outbreak :----------

Details of investigation

Describe how cases were found (may include (a) house to house search in the affected area; (b) visiting blocks adjacent to the affected area; © conducting record reviews at local hospitals; (d) requesting health workers to report similar cases in their areas etc.):

_____

_____

_____

_____

_____

Descriptive epidemiology

Cases by time, place and person (attach summary tables and relevant graphs and maps)

Age specific attack rates and mortality rates

High risk age groups and geographical areas

Vaccination status of cases, unaffected population

Prevalence and density of JE vectors

Prevalence of reservoirs specially pigs

Description of control measures

Description of measures for follow-up visits:

Brief description of problems encountered:

Factors which ,in your opinion , contributed to the outbreak

Conclusions and recommendations

Date (Name and designation)

Format for MPWs for reporting suspected JE case

Village_____

District_____

Name_____

Age_____Sex_____

Address_____

Fever____Yes/No__
Date of onset_____
Headache__Yes/No__
Stiffness in Neck____Yes/No__
Fits __Yes/No__
Weakness of extremities ____Yes/No__
Vomiting___Yes/No_
Unconsciousness ____Yes/No__

Recovered/still suffering/death with date_____

House : Kacha/Pacca

Animals - Pigs/Cattle/Buffalo/Goat/Hens/Ducks etc.

Sleeping habit - Outside/same room with animals/separate room

Format for medical officers for reporting JE case

District_____ Village_____
House No._____ Head of Family_____
Date of Survey_____

Particulars of Patient:

Name_____Age(Years)_____Sex: M/F
Father's Name_____ Date of onset of illness _____
Recovered / Still suffering / Died on_____
Date of investigation_____
Informant_____

Symptoms

Fever (more than 100 ^{0} F): Yes / No
Headache : Yes / No
Neck rigidity : Yes / No
Convulsions: Yes / No
Unconsciousness : Yes / No
Sequelae:
Some form of paralysis : Yes / No
Involuntary movements: Yes / No

Similar illness in family/neighbourhood:
Name_____Age_____Sex_____Date of onset_____

Clinical laboratory investigations

Samples sent for confirmation of diagnosis (and results, if available)

Diagnosis

(Signature & Designation)

INTER-DEPARTMENTAL COMMITTEE
SUGGESTED AREAS OF RESPONSIBILITY AND ACTION

District administration

- mobilize resources by organizing meetings with
  - concerned government departments
  - non-governmental agencies
  - community leaders
- ensure vector control measures
- ensure adequate facilities for transportation of serious patients to district hospital, if necessary
- provide relevant information to the press
- monitor status of control activities

District Health Office / Municipal Health Office

- alert health personnel to report cases and to monitor trends arrange active surveillance in affected area
- arrange health educational camps and distribution of health educational material
- arrange vector control measures
- arrange drugs and fluids in nearest hospital in adequate quantity
- convene meeting under district administrator to seek co-operation of other government departments and NGOs

Concerned Department (s) responsible for agriculture and animal husbandry

- ensure measures for reducing factors favouring the breeding of mosquitoes
- support measures for vector control
- take precautionary measures where piggery development projects are initiated
- report suspected cases of JE

Other government departments such as social welfare, education, tribal welfare and NGOs, and Panchayat members, village pradhans and community leaders

- ensure measures for reducing factors favouring the breeding of mosquitoes
- support measures for vector control
- take precautionary measures where piggery development projects are initiated
- report suspected cases of JE
- arrange transportation of serious cases to hospital

Teaching module No. 6

INVESTIGATION & CONTROL OF OUTBREAKS

DENGUE FEVER & DENGUE HAEMORRHAGIC FEVER

National Disease Surveillance Programme

Directorate of Health & F. W. Services
Bangalore-560 009, Govt. of Karnataka

INVESTIGATION & CONTROL OF OUTBREAKS

DENGUE FEVER & DENGUE HAEMORRHAGIC FEVER

NATIONAL INSTITUTE OF COMMUNICABLE DISEASES
(DIRECTORATE GENERAL OF HEALTH SERVICES)
22-SHAM NATH MARG, DELHI - 110 054

1998

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1. Introduction

1.1. Dengue virus infections are significant causes of morbidity and mortality in many parts of the world, including India. The dengue virus is believed to cause two forms of clinical syndrome, namely, classical dengue fever (DF) and dengue hemorrgahic fever/dengue shock syndrome (DHF/DSS).

1.2. Dengue fever is a self - limiting disease and represents the majority of cases of dengue infection. In some situations, it manifests in severe forms as haemorrhagic (DHF) and shock syndrome (DSS).

1.3. In India, dengue infection is known to exists in endemic proportions for a very long time. The first major outbreak of dengue fever accompanied by dengue haemorrhagic fever was reported in Calcutta in 1963. About sixty outbreaks have been reported during the period 1956 to 1996. Because dengue infections have the potential of rapid spread leading to an acute public health problem, special attention is required to be paid for its surveillance, prevention and control.

2. Notification of cases

2.1. Cases of DF/DHF must be reported monthly to Directorate of National Malaria Eradication Programme (NMEP) through the concerned state nodal officer. A report may be endorsed to the Director, National Institute of Communicable Diseases (NICD), 22-Shamnath Marg, Delhi 110054; Phone:-2521060, 2521272, 2913148; FAX: 2922677; Telegram: COMDIS, DELHI.

2.2 If there is a sudden increase or clustering of cases or deaths due to DF/DHF, it must be reported immediately to the district health office. The district health office must similarly inform the concerned health officer by the quickest mode of communication, preferably through telephone, Fax or e-mail with details of the outbreak including investigation and control measures initiated. The National Institute of Communicable Diseases is expected to be kept informed of the action taken.

3. Causative agent

DF/DHF is caused by a group B arbovirus (Flavivirus) and include serotypes 1,2,3 and 4 (Den-1, Den-2, Den-3 and Den-4).

4. Incubation period

The incubation period is usually 5-6 days but may vary from 3 to 10 days.

5. Mode of transmission

5.1 The infection is transmitted by the bite of an infected female mosquito- *Aedes aegypti*. The mosquito usually bites during day time. The mosquito becomes infected by biting a patient with dengue infection. Once the mosquito becomes infected, it remains so for life. The female mosquitoes can survive upto 3 weeks under normal temperature and humidity.

5.2 Female mosquitoes get infected after feeding on a viraemic host. They can transmit the virus to human host after an extrinsic period of 8-10 days. The ambient temperature range for dengue transmission is 16^{0}C to 40^{0}C. Below 16^{0}C *Aedes aegypti* ceases to bite.

6. Vector of transmission

6.1 *Aedes aegypti* is the main vector of dengue transmission in India. Dengue outbreaks have also been attributed to *Aedes albopictus*. However, *Aedes polynesiensis* and species of *Aedes scutelloris* complex have also been incriminated as vector in other South East Asian countries.

6.2 The mosquito has characteristic white strips on the back and legs. It is also known as Tiger mosquito (figure).

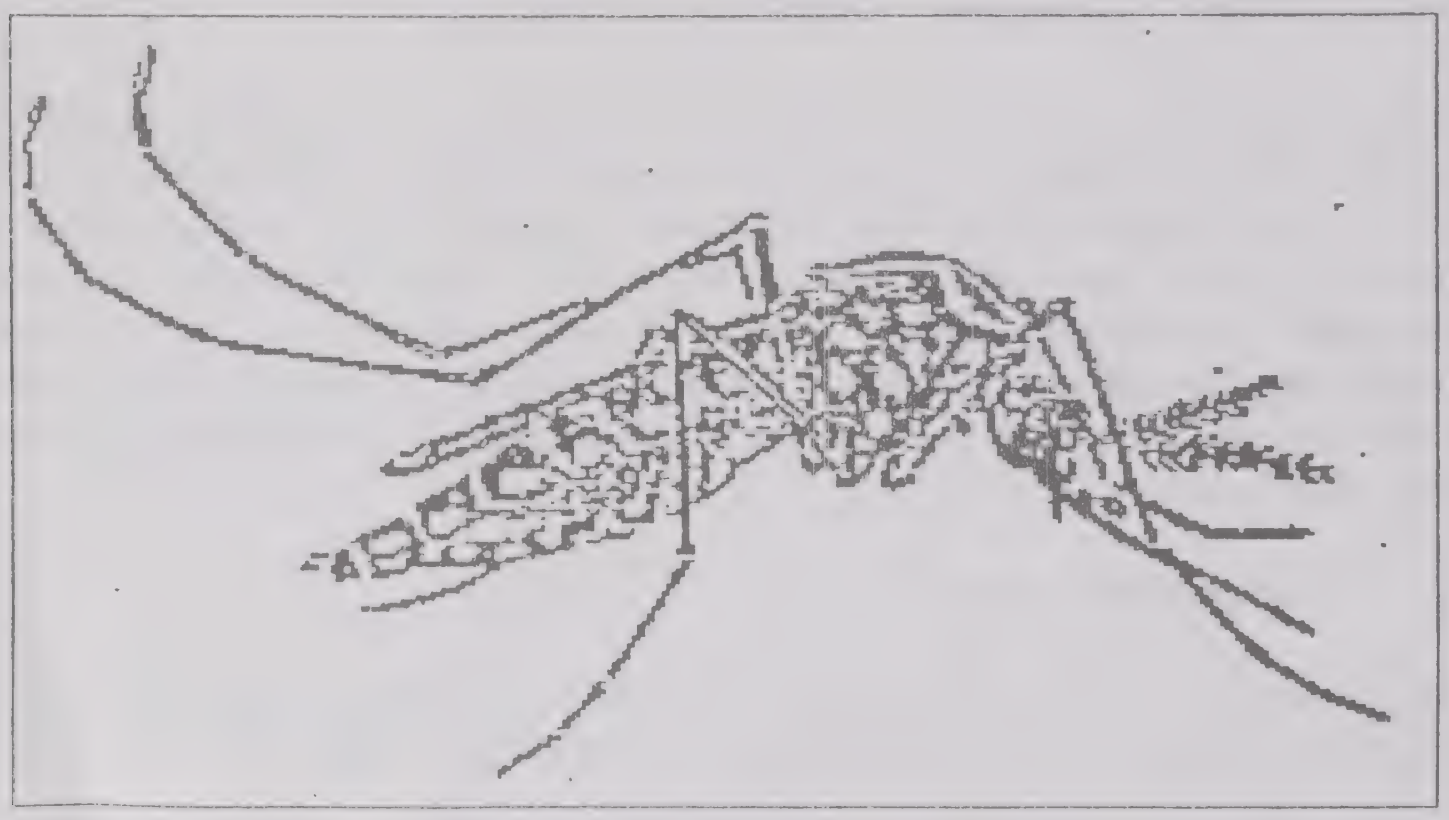

Figure. Aedes aegyptii

6.3 The mosquito rests indoors, in closets and other dark places. Outside, they rest where it is cool and shady. The female mosquito lays eggs in clean water containers in and around homes, schools and work places. The larvae hatch from the mosquito eggs, and live in the water for about a week; they then change into a round pupal stage for one or two days after which the adult mosquito emerges, ready to bite.

6.4 The mosquito is a domestic breeder. Mosquito breeding can occur in any water catching or water storage containers such as desert coolers, overhead tanks, discarded buckets, tyres, utensils and large containers used for collecting rain water which are not emptied and cleaned periodically. Since water is essential during the first 8 days in the life of mosquito, emptying containers once a week will greatly reduce the risk of dengue fever.

6.5 *Aedes* mosquito can fly upto a limited distance of 400 meters but can spread over vast distances mechanically in various types of vehicles used by man.

6.6 The outbreaks of dengue fever/DHF are most likely to occur in the post-monsoon period when the breeding of the mosquitoes is highest.

7. High risk areas

7.1 Usually, urban areas, having high population density, poor sanitation and large number of desert coolers, overhead tanks, discarded buckets, tyres, utensils etc. which promote mosquito breeding, are at high risk.

7.2 Dengue fever /DHF can also occur in rural areas where the environment is friendly for mosquito breeding. Mosquito breeding can occur, for example, in large containers used for collecting rain water, which are not emptied and cleaned periodically.

8. Clinical manifestations and case definitions

8.1 Dengue fever (DF)

The symptoms of dengue fever are similar to acute fevers of viral origin. These are sudden onset of fever, headache, bodyache, joint pains and retro-orbital pain. Other common symptoms include anorexia, altered taste sensation, constipation, colicky pain, abdominal tenderness, dragging pains in the inguinal region, sore throat and general depression.

Patient may or may not have rash. Some of the patients may also show signs of bleeding from the gum, nose etc.

CASE DEFINITION OF DENGUE FEVER

SUSPECT CASE

- Acute onset
- High fever of less than seven days duration
- Severe headache, backache
- Joint and muscle pain and pain behind eyes
- With or without rash

PROBABLE CASE

- Suspect case of DF
- High vector density
- Presence of confirmed case in the area
- Blood slide -ve for malarial parasite & patient does not respond to anti-malarial drugs

CONFIRMED CASE

- Isolation of virus from blood in early phase
- Serological test for IgM antibody in single serum samples, or 4 fold rise of antibodies in paired serum samples

8.2 Dengue Haemorrhagic Fever (DHF)

DHF is a severe form of dengue fever. Typically, it begins abruptly with high fever accompanied by headache, anorexia, vomiting and abdominal pain. During the first few days, the illness resembles classical dengue fever, but a maculopapular rash is less common.

A haemorrhagic diathesis is commonly demonstrated by scattered fine patchiae on the extremities, face and trunk and in the axillae. A positive tourniquet test and a tendency to bruise at venepuncture site are always present. Bleeding from the nose, gums and gastrointestinal tract are less common. Haematuria is extremely rare.

The liver is usually enlarged, soft and tender. Approximately 50% of patients have generalized lymphadenopathy.

The critical stage is reached after 2-7 days, when the fever subsides. Accompanying or shortly after a rapid drop in body temperature, varying degree of circulatory disturbances occur. The patient is usually restless and has cold extremities. Sometimes there may be sweating.

In less severe cases, the changes in vital signs are minimum and transient. The patient recovers spontaneously or recovers after a brief period of therapy.

CASE DEFINITION OF DHF

SUSPECT CASE

- Acute onset
- High fever of less than 7 days duration
- Severe headache, backache
- Joint and muscle pain and pain behind eyes
- Bleeding tendencies

PROBABLE CASE

- Suspect case of DHF
- Positive tourniquet test

CONFIRMED CASE

- Probable case
- Thrombocytopenia ≤ 1,00,000/mm.^{3}
- Heamoconcentration (haematocrit increased by ≥ 20% or evidence of increased capillary permeability(e.g. pleural effusion in X-ray chest).

DHF is clinically confirmed by the positive tourniquet test (a blood pressure cuff is used to impede venous flow. A test is considered positive if there are >20 petechiae/square inch).

STANDARD TOURNIQUET TEST

- Apply sphygmomanometer cuff to the arm and take Blood pressure..
- Inflate cuff so that it registers a pressure midway between that of systolic and diastolic blood pressure.
- Hold it for five minutes.
- Examine the cubital fossa for petechiae if >20 petechiae in 3 cm diameter circles, the test is positive, if >20 petechiae in 2.5 cm square, the test is positive.

Haematocrit increase by 20% or more of the baseline value

Thrombocytopenia and haemoconcentration are constant findings in DHF. Haemoconcentration- indicating plasma leakage- is always present.

CLINICAL LABORATORY FINDINGS

- **A platelet count of 1,00,000/mm^3 or less between the third and eighth day of illness**
- **Haematocrit increase by 20% or more of the baseline value**

In more severe cases, shock ensues and the patient may die within 12-24 hours. Prolonged shock is often complicated by metabolic acidosis and severe bleeding, which indicate a poor prognosis. If the patient is appropriately treated before the irreversible shock has developed, rapid recovery is the rule.

A major cause of deaths due to DHF is leakage of plasma in the pleural and abdominal cavities leading to hypovolaemic shock. **Determination of haematocrit and platelet is essential for diagnosis and case management.** The time course relationship between the fall in platelet count and a rise in haematocrit level appears to be unique to DHF. These changes occur before the subsidence of fever and before the onset of shock and are correlated with the disease severity.

Encephalitic signs associated with intracranial haemorrhage, metabolic and electrolyte disturbances, and hepatic failure (a form of Reye's syndrome) may occur. They are uncommon but carry a grave prognosis.

9. Differential diagnosis of DHF/DSS

Early in febrile illness, the differential diagnosis includes a wide spectrum of viral and bacterial infections.

The presence of marked thrombocytopenia with concurrent haemoconcentration differentiates DHF/DSS from other diseases such as endotoxic shock from bacterial or meningicoccaemia. In patients with severe bleeding, evidence of pleural effusion and/or hypoproteinaemia may indicate plasma leakage.

10. Laboratory confirmation of diagnosis

10.1 The diagnosis of DF/DHF can be confirmed by serological tests. The tests include detection of IgM antibodies which appear around the

end of first week of onset of symptoms and are detectable for 1-3 months after the acute episode.

10.2 A rising titre of IgG antibody in paired sera taken at an interval of ten days or more is confirmatory.

10.3 IgG antibodies indicate previous infection and are useful for conducting sero-epidemiological studies to determine the extent of silent infection and immunity levels in the local population.

10.4 Antigen is produced in limited quantities for operational research and outbreak investigations at the National Institute of Virology (NIV), Pune. With the antigen received from NIV, the National Institute of Communicable Diseases (NICD) supports outbreak investigations on the request from the state health authorities. The antigen is also commercially available.

10.5 Blood for serological studies should be carefully collected taking due universal precautions from suspected DF/DHF cases (a) as soon as possible after hospital admission or attendance at the clinic (S-1) (b) shortly before discharge from the hospital (S-2) and (c) if possible, 14-21 days after disease onset (S-3). Failure to leave an interval of 10-14 days between collection of S-1 and S-2 samples may prevent the serological diagnosis of primary dengue infection. Specimen containers should be clearly labelled.

10.6 Each specimen should be accompanied with the detailed information about the case as given in the box so that the results could be scientifically interpreted.

INFORMATION WHICH SHOULD ACCOMPANY EACH SAMPLE

- name of the patient
- name of the mother / father
- age
- sex
- complete residential address
- name of the hospital / PHC sending the sample
- registration number of the patient
- date of onset of illness
- date of hospitalisation
- date of collection of sample
- provisional diagnosis
- brief clinical findings
- results of clinical laboratory investigations

11. Clinical management

11.1 Management of Dengue fever

The management of Dengue fever is symptomatic and supportive and comprises of :

- Bed rest is advisable during the acute febrile phase
- Antipyretics or sponging are required to keep body temperature below 39°C. **Salicylates should be avoided.** Paracetamol may be prescribed.
- Analgesics or a mild sedative may be required for those with severe pain
- Home available fluids and ORS solution are recommended for patients with excessive sweating, nausea, vomiting or diarrhoea to prevent dehydration.

11.2 Management of DHF

- Management during febrile phase is similar to that of DF
- Antipyretics may be indicated but **salicylates should be avoided.**
- Increased fluid intake
- Fluid and electrolyte replacement by IV fluids, isotonics etc.
- Plasma expanders, if clinically indicated
- Fresh frozen plasma may be indicated in some cases
- Blood transfusion

As thrombocytopenia and concurrent haemoconcentration usually occurs well before the onset of shock, the use of these criteria can enable the clinician to make early diagnosis at the time the plasma leakage starts and hence early fluid replacement for plasma loss can be administered and disease severity can be modified. Prolonged shock is often complicated by severe massive bleeding and grave prognosis.

Judicious volume replacement is mandatory as the plasma loss is only for 24 to 48 hours and is more rapid around the time of defervescence and /or shock. Haematocrit determination is essential for monitoring the rate of IV fluid infusion and to check overload (which has been recognised as a common problem).

Isotonic solution (0.9% sodium chloride, also known as normal saline) or a compound solution of sodium lactate is preferred. Saline with or without glucose can be used depending upon availability. Glucose solution without saline do not provide the salt required to restore electrolyte balance and is not recommended.

Transfusion of platelets does not change the course of the illness and is not recommended. Blood transfusion may be indicated in patients with severe shock, massive bleeding and DIC.

Amount of fluid given should be constantly monitored. Any evidence of swelling, shortness of breath or puffiness may indicate fluid overload.

12. Pathogenesis and pathophysiology

The pathogenic mechanism of DHF is not clear, but two main pathophysiologic changes occur:

(a) vascular permeability increases which results in plasma leakage, leading to hypovolaemia and shock

(b) abnormal haemostasis, due to vasculopathy, thrombocytopenia and coagulopathy, leading to various haemorrhagic manifestations.

The severity of DHF as compared with dengue fever may be explained by the enhancement of virus multiplication in macrophages by heterotypic antibodies resulting from a previous dengue infection. There are evidences suggesting that cell mediated immune response may also be involved in the pathogenesis of DHF.

13. Immunity

Infection with one serotype provides life-long homologus immunity but does not provide protection against other serotypes, and instead may exacerbate subsequent infection.

14. Surveillance in DF/DHF

Surveillance is prerequisite for monitoring the dengue situation in the area and should be carried out regularly for early detection of an impending outbreak and to initiate timely preventive and control measures. Surveillance should include epidemiological, entomological and laboratory parameters.

14.1 Epidemiological surveillance

The epidemiological surveillance should include the following:

- Fever surveillance

- Diagnosis based on standard case definition
- Reporting of DF/DHF cases to state health authorities
- During an outbreak situation, samples of about 5% of clinically diagnosed cases should be tested for confirmation of diagnosis by the laboratory.

The peripheral health staff should be alerted to report increase or clustering of acute febrile illness compatible with the case definition of DF/DHF. Such increase of cases should be investigated locally, including entomological investigation to check for vector density in the area.

14.2 Vector surveillance

A number of indices have been described and are currently used to monitor the vector population in a defined area:

1. **House index-** Percentage of houses positive for larvae of *Aedes aegypti.*

2. **Breteau index-** Number of positive containers for *Aedes aegypti* per 100 houses.

3. **Container index-** Percentage of containers positive for *Aedes* breeding.

Epidemiological interpretation of various entomological indices		
Entomological indices	***High risk of transmission***	***Low risk of transmission***
Breteau index	>50	<5
House index	>10%	<1%

Container index :Container index mostly utilised for drawing vector control strategy.

In areas where *Aedes aegypti* is absent or very scarce and dengue outbreaks occur, a special effort should be made to identify the local vector(s) to develop vector surveillance accordingly.

15. Investigation of an outbreak

15.1 The investigation of an outbreak of DF/DHF is similar to the investigation of other epidemic prone diseases. The first principle is to receive early signals, confirm diagnosis and to take prompt measures

for control of the outbreak. Control measures are most effective when selective measures are applied early.

Factors increasing the risk of DF/DHF outbreaks

- Increasing urban population
- Expanding mosquito breeding due to:
  - shortage of water supply,
  - traditional water storage,
  - poor garbage collection,

  (create more mosquito breeding places)
- Changing life style (use of water coolers etc.)
- Rapid transportation

15.2 Line list of cases, including age, sex and address and other details should be maintained and also reported to district health office (**Annexure 1&2**). Active search should be made for more cases. Serum samples should be collected for laboratory confirmation of diagnosis.

15.3 Vector surveillance should be immediately initiated and should include collection of adult mosquitoes, identification of mosquito species and density, assessment of susceptibility of vectors to available insecticides.

15.4 Arrange health educational activities in the community regarding prevention of mosquito bites by use of mosquito nets and mosquito repellent creams, mosquito breeding by drying out water containers at least once a week, residual insecticide spray, wearing of protective clothing and reporting suspected cases at the health facilities early.

15.5 On confirmation of an outbreak of DF/DHF, take precautionary measures in other neighbouring high risk areas.

15.6 After the outbreak is over, a detailed report must be written. Format for outbreak investigation is given at **Annexure 3.**

16. Prevention and control of an outbreak

PREVENTION AND CONTROL OF DF/DHF OUTBREAK

- Initiate vector surveillance and control measures
- Conduct IEC
- Community participation
- Assess facilities for case management of patients with haemorrhagic shock
- Alert health personnel to report increase/clustering of cases

16.1 A surveillance system should be established so that DHF is immediately reported to the local health authorities. Necessary field investigations must be carried out in the area of residence of the patient to check for vector.

16.2 The preventive measures are directed at reducing the vector density and in taking personal protection to prevent the bite of mosquitoes.

PREVENTION OF MOSQUITO BITES

- Wear cloths that cover arms and legs during outbreak situations
- Use mosquito nets or insect repellents while sleeping at night to keep away mosquitoes
- Children should preferably not wear shorts and half sleeved cloths
- Keep patients protected from mosquito bite in acute phase

16.3 Immediate measures are called for to reduce the density of mosquitoes by use of insecticides. The public should also be informed to take necessary precautions against mosquito bite such as use of full sleeved clothes, mosquito nets at night and mosquito repellent creams, if necessary.

ELIMINATION OF MOSQUITO BREEDING PLACES

- Empty water containers at least once a week
- Cover and seal septic tanks and soak-away pits
- Removal of rubbish
- Remove water from coolers and other places where water has remained stagnant

16.4 Long term measures include the recommended steps for vector control under the National Malaria Eradication Programme(NMEP).

16.5 Pockets of high risk should be identified so that these areas could be given more attention with regard to control measures, health educational activities and field supervision.

16.6 Isolation of patients and disinfection of secretions and excretions are not required as DF /DHF virus is not transmitted from person to person.

16.7 Patients should be treated in nearby health centre/ hospital where the facilities for platelet count and haematocrit value estimation are available. These parameters are essential to monitor clinical status

of the patients. Haematocrit levels are required to know the degree of plasma leakage and determine the impact of fluid replacement to avoid fluid overload.

17. Community participation

17.1 Community participation is essential for the prevention and control of an outbreak of DF/DHF. The community must be encouraged to take steps to protect themselves from mosquitoes by eliminating mosquito breeding sites and taking personal measures such as use of bed nets, mosquito repellents etc. The co-operation of the community is also important during the periodic insecticide spray.

17.2 In pockets of high risk, active surveillance of DF/DHF should be encouraged so that first case(s) is (are) immediately reported to the local health authorities.

17.3 Co-ordinated efforts by government departments such as sanitation, urban development, education etc are essential so that risk factors for mosquito breeding can be reduced and other control measures taken up effectively.

17.4 In an event of an outbreak, the co-operation of other government departments will help to bring it more effectively under control. An inter-departmental committee for outbreak prevention and control should be constituted which should meet more periodically. Panchayat members, key community representatives and NGOs should be included as members of the committee. A meeting of the committee should be convened before the expected seasonal increase of water and vector borne diseases. In districts where risk factors exist, status of control measures for DF/DHF should also be assessed. The suggested areas of responsibilities of the various departments is given in **Annexure 4.**

Annex 1

Format for MPWs for reporting suspected DHF case

Village_____

District_____

Name_____

Age_____Sex_____

Address_____

Fever____Yes/No__

Date of onset_____

Headache__Yes/No__

Bleeding __Yes/No__

Cold extremities ____ Yes/No__

Unconsciousness ____Yes/No__

Recovered/still suffering/death with date_____

House : Kacha/Pacca

Mosquito breeding : Desert coolers/Over head tanks/discarded tyres/Buckets/Others

Date:

Signature
(Name and designation)

Annex 2

FORMAT FOR MEDICAL OFFICERS FOR REPORTING DHF CASE

District_____ Village_____
House No._____ Head of Family_____
Date of Survey_____

Particulars of Patient:

Name_____Age(Years)_____Sex: M/F
Father's Name_____ Date of onset of illness _____
Recovered / Still suffering / Died on_____
Date of investigation_____ Informant_____

Symptoms

Fever (more than 100 ^{0} F): Yes / No
Headache : Yes / No
Haemorrhagic manifestations Yes/No
-Petechiae. Purpura, Ecchymosis
-Epistaxis, Gum bleeding
-Haematemasis and or melena
Tourniquet test: Positive/Negative
Enlarged liver: Yes / No
Shock: Yes / No
Other signs: _____

Similar illness in family/neighbourhood:
Name_____Age_____Sex_____Date of onset_____

Clinical laboratory investigations
Haematocrit (%)
Platelet count

Samples sent for confirmation of diagnosis and result if available
Acute sera sent: Yes/No, Date of collection:
Convalescent sera sent: Yes/No

Signature
(Name and designation)

Date:

Name of PHC / Hospital

OUTBREAK INVESTIGATION REPORT

General information

State :----------

District : ----------

PHC/Town :----------

Village/Ward :----------

Population :----------

Background Information

Person reporting the outbreak :----------

Date of report :----------

Date investigations started :----------

Person(s) investigating the outbreak :----------

Details of investigation

Describe how cases were found (may include (a) house to house search in the affected area; (b) visiting blocks adjacent to the affected area; © conducting record reviews at local hospitals; (d) requesting health workers to report similar cases in their areas etc.):

_____

_____

_____

_____

_____

Descriptive epidemiology

Cases by time, place and person (attach summary tables and relevant graphs and maps)

Age specific attack rates and mortality rates

High risk age groups and geographical areas

Prevalence and density of dengue vectors

Description of control measures

Description of measures for follow-up visits:

Brief description of problems encountered:

Factors which ,in your opinion , contributed to the outbreak

Conclusions and recommendations

Date:

(Name and designation)

INTER-DEPARTMENTAL COMMITTEE
SUGGESTED AREAS OF RESPONSIBILITY AND ACTION

District Administration

- mobilse resources by organising meetings with
  - concerned government department
  - non-governmental agencies
  - community leaders
- ensure vector control measures
- ensure adequate facilities for transportation of serious patients to district
  hospital if necessary
- ensure adequate supply of drugs and insecticides
- provide relevant information to the press
- monitor status of control activities

District Health Office/Municipal health office

- alert health personnel to report cases and to monitor trends
- arrange active surveillance in affected area
- arrange health educational camps and distribution of health educational material
- arrange vector control measures
- convene meeting under district administratror to seek co-operation of other
  government departments and NGOs
- alert hospitals for prompt management of cases

Concerned department (s) responsible for agriculture and sanitation

- ensure measures for reducing factors favouring the breeding of mosquitoes
- suppport measures for vector control
- report suspected cases of DF/DHF

Other government departments such as social welfare, education and NGOs, and Panchayat members, village pradhans, community leaders

- ensure measures for reducing factors favouring the breeding of mosquitoes
- support measures for vector control
- report suspected cases of DF/DHF
- arrange transportation of serious cases to hospital
- ensure community participation